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Science

THE SCIENTISTS NEWSWEEKLY

The winners of the $2,400 Westinghouse scholarships in the 6th Annual Science Talent Search at an awards banquet at the Hotel Statler, Washington, on March 4: Martin Karplus, Newtonville, Massachusetts, who plans to enter Harvard as a premedical student this fall, and Vera Radioslava Demerec, Cold Spring Harbor, New York, who plans to enter Swarthmore. Pictured with the winners are Harlow Shapley, president of AAAS and chairman of the Board of Trustees, Science Service; Vannevar Bush, who delivered a congratulatory address at the banquet; and Watson Davis, director of Science Service, who acted as toastmaster.

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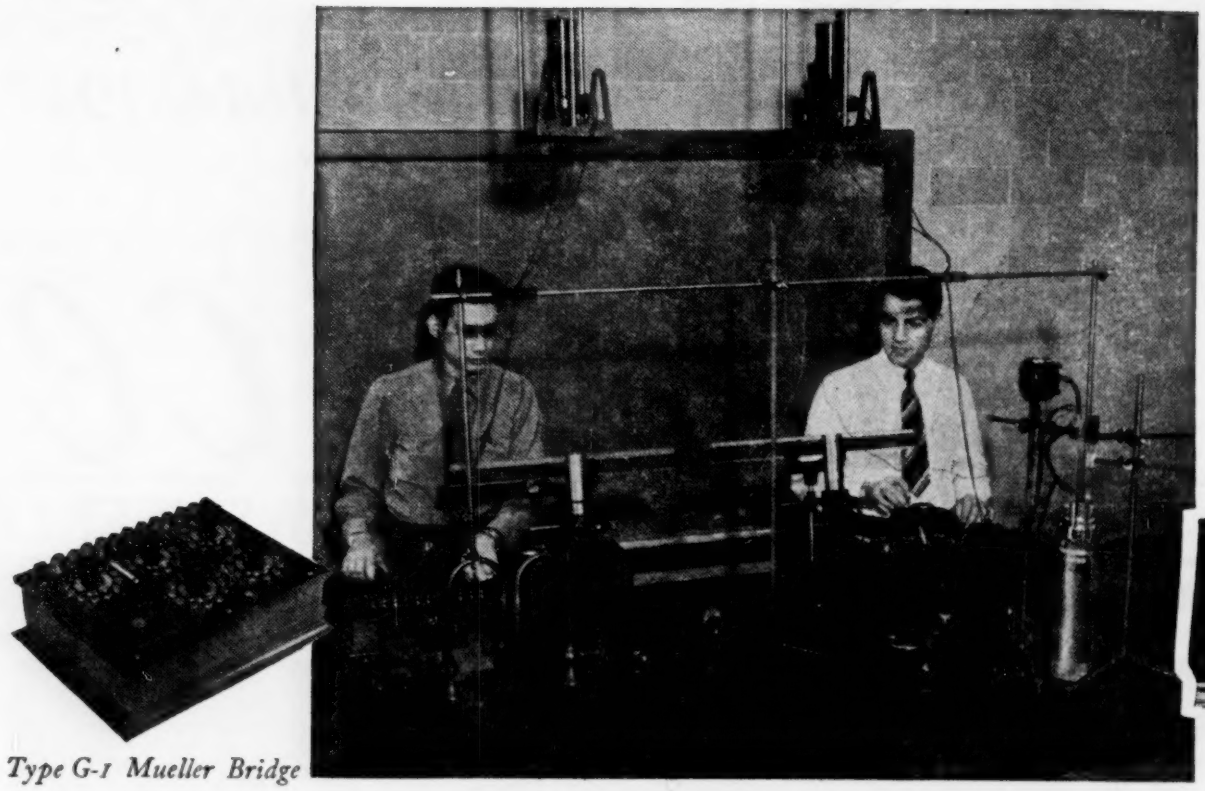
Medicine and National Health in the USSR

Stuart Mudd



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Science

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rograms for Medicine and National Health in the USSR

Stuart Mudd, ***President of the American-Soviet Medical Society*** **and**
Professor of Bacteriology, Medical School, University of Pennsylvania

PPORTUNITY FOR OBSERVATIONS IN 20 medical institutions and for acquaintance with some 200 professional persons was afforded Robert L. Leslie, Mrs. Mudd, and myself in the course of a visit to the Soviet Union between the middle of August and the middle of September 1946. Arrangements for the trip were initiated by Dr. Leslie in behalf of the American-Soviet Medical Society and the *American Review of Soviet Medicine*. Our official hosts were Vladimir Semenov, president, and A. Karaganov, vice-president, of VOKS, the Society for Cultural Relations With Foreign Countries, and their courteous staffs. Medical facilities were made open to us, particularly through V. V. Parin, secretary-general of the Academy of Medical Sciences of the USSR and vice-president in charge of the Medical Section of VOKS, and N. N. Priorov, vice-minister of Public Health of the USSR.

The warmth, friendliness, and openness of our professional colleagues in discussing matters of common interest were intensely gratifying. We found the Soviet scientists, who were eager to have us see, understand, and appreciate their work, far better acquainted with the technical literature of western Europe and America than our scientists are with Soviet material. The standard journals were seen in Soviet institutional libraries and were obviously read with understanding.

The attitude of our Soviet colleagues was not a result of lack of realization that the political atmosphere was surcharged with tensions: our lay press is also available in Soviet libraries, and their press is outspoken with respect to political issues. Their attitude is determined, we believe, by tragic and personal experience of suffering, loss, and deprivation caused by the war, by a profound need for peace and security in which to rebuild their country and to provide the necessities and the niceties of life, and finally, by a realization that the scientists' world is, indeed, one. And, of course, Soviet scientists have the very human desire to know their colleagues elsewhere and to be known and appreciated by them.

Progress in the Study of Higher Nervous Activity—Relationships to Mental Health

Evidences of the myriad ramifications of the work of the great Pavlov and his school were among the most interesting scientific activities observed. Pavlov worked until his death in the physiological laboratory of the Institute of Experimental Medicine, Leningrad, founded in 1890 and the oldest institute of its kind in Russia. Pavlov's laboratory, with a staff of 11 people, is now in charge of P. S. Kupalov. Rooms for the experimental study of conditioned reflexes and operating rooms are in active use, and pictures concerning Pavlov's association with the late Walter B. Cannon are prominently displayed. Experimental studies conducted even during the war have been published in the *Transactions* of the Physiological Laboratory of Pavlov, and Prof. Kupalov has in preparation a monograph in extension of Pavlov's writings.

Pavlov, feeling the need for more space, built a small laboratory in Koltushi, a suburb of Leningrad, and asked the government for 1,000,000 rubles for its support. He received 12,000,000 rubles. Building of the extensive laboratories and of the community now known as Pavlova was begun in 1929. After Pavlov's death in 1936, at the age of 86, the institute at Pavlova was put in charge of Academician L. A. Orbeli, who decided to undertake the study of the evolution of the nervous system on a large scale. The institute thus became the Institute of Evolutionary Physiology and Pathology of Higher Nervous Activity. This now has a staff of 90 workers, with 45 more in the associated clinic for the study of children. The administrative office is decorated with pictures of Sechenov, Claude Bernard, Johannes Müller, Darwin, Huxley, Sherrington, and the Georgian physiologist, Torchanishvili.

Study of the activities of the nervous system at many levels of the phylogenetic scale are in progress at Pavlova. There we were privileged to meet E. Ganicke, for 40 years a collaborator of Pavlov, who has studied the comparative physiology of the conditioned reflex and has repeated in mice Pavlov's work with dogs. Prof. Ganicke stated that he had been able to demonstrate conditioned reflexes even in insects and in mollusks, though obviously at a primitive level. Under other investigators work is proceeding on a monkey colony, and behavior of children is observed at an associated clinic.

Ontogenetic development receives equal attention at Pavlova. The comparative development of the neuromuscular apparatus and its behavior is under study in embryos and newborn of various animals. Effects of altered environmental conditions, such as O_2 and CO_2 tension, blood sugar level, etc. during embryonic development, are also studied.

An abridged version of this report, which was presented before the American Philosophical Society in Philadelphia, October 19, 1946, appears in the *Proceedings of the American Philosophical Society*, 1947, 91, 181-188.

Development of nervous activity during the maturing of rabbits, mice, rats, guinea pigs, dogs, monkeys, and humans is under investigation. The cerebral cortex has been found to be relatively undifferentiated functionally in the newborn. The work at Pavlova has demonstrated that in nervous activity, as in morphology, "ontogeny recapitulates phylogeny."

The inheritance of higher nervous functions in genetically known lines of dogs is also under investigation. The "nursery for dogs' children" is well designed and obviously the object of scrupulous care.

M. K. Petrova, for 25 years a collaborator of Pavlov, is one of the most creative of his school. She has achieved much of Pavlov's original intent of imitating experimentally in animals characteristic pictures of neuroses and psychoses as they occur in man. Volume 12, 1945, of the *Transactions* of the Physiological Laboratory of Pavlov, which she presented to us, contains eight of her own articles, covering 221 pages. Summaries are in English. Experimentally induced phobias in dogs are described. Weakening of inhibitory processes in the central nervous system is shown to be an indispensable condition for the appearance of such phobias. The nature of the phobia is closely connected with some event previously experienced by the dog and strongly affecting it. The weakening of the inhibitory process could be brought about and the phobia made manifest by prolonged overstrain, prolonged use of conflicting conditioned reflexes, or chronic alcoholization of the animal. Following amelioration of the conditions cited, phobias disappeared as soon as nervous equilibrium was restored.

Dogs have also been observed over many years in which anxiety states produce trophic disturbances of the skin. Continuous observation of one dog throughout six years "showed that trophic disturbances in the form of extensive exudative eczema appeared every time her nervous activity weakened under prolonged periods of daily work which was beyond her strength." Easing of the work and rest to restore weakened nervous activity resulted in complete restoration of nervous equilibrium, together with healing of trophic lesions. Such anxiety neuroses and their accompanying skin dystrophies also responded well to prolonged sleep induced by veronal or hypnosis. Relapse was induced by the prolonged action of alcohol. Further detailed studies are presented by Petrova on the effects on the higher nervous activity and symptomatology of dogs of varying nervous constitutions of prolonged administration of thyroid extract, alcohol, bromine, caffeine, and other drugs. Some of this material is in preparation for detailed publication in the *American Review of Soviet Medicine.*

Other outgrowths of the work of the Pavlov institutes were seen at Sukhumi, in Georgia, near the Black Sea. Here an extensive primate colony is maintained as a biological experiment station of the Academy of Medical Sciences of the USSR. The director, L. G. Voronin, is a former member of Pavlov's staff. Many aspects of phy iology, psychology, and pathology of these primates a studied in comparison with similar aspects in man. remarkable feature is the study of behavior under natur conditions, in great enclosures of natural tropical jungl We were particularly interested in the observations relationships of mothers and young in *Macacus rhesu* monkeys and in an "orphanage" of motherless macaque These little "orphans" were under the care of a form school teacher, and their remarkable confidence in h was reminiscent of the relationships of trust and kindnes between children and teachers in the Soviet nurseri and schools visited.

To what extent are all these comparative studies o nervous activity contributing to the practical manage ment of mental disease and to the securing of menta health? An American psychiatrist, K. E. Appel, ha recently written:

> Modern psychiatry rests to a great extent on the work three men: a Russian, an American, and an Austrian. Th importance of the emotions, and their effect on the biologic organism, was brilliantly studied by Walter Cannon. The o ganization of responses and the conditions of learning were i geniously investigated and worked out by Pavlov in his studi of the conditioned reflex. The *effects* of conditioning or trai ing, both parental and social, on the development of th human personality were the contributions of Freud (*Ame Rev. Soviet Med.*, 1946, **3** (Suppl.), 32–39).

V. A. Gilyarovski, director of the Institute of Ps chiatry in Moscow, when asked a similar question duri our visit to that institution, replied that the contr butions of the Pavlov school were of the greatest im portance to practical psychiatry and that the physi logical approach to mental disease, in his opinion, w definitely more valuable than the Freudian. Physiologic and chemical work is particularly cultivated in th Institute. Great attention is also paid to psychiatric wor with children.

The great importance of psychiatry has become ev more manifest in the USSR since the end of the wa Dr. Gilyarovski stated that functional disturbances the nervous system did not increase in the Red Arm during the war. This he attributed to the high mora (the wholehearted devotion of the troops to the defens of their country), the good attitude of the officers, and th low rate of infectious diseases in the Red Army. The in cidence of endogenous psychiatric illnesses has not in creased since the war's end. That of functional distur ances of the nervous system did increase in places und German occupation and has increased in general since th end of the war. When a person is in high spirits, said D Gilyarovski, he can do everything better than when he depressed and upset, but after a period of prolong nervous strain comes a period of reaction. Dispensa care at an early stage is particularly important for th

of men in the period of reaction following demo-
ation.

Particular attention is being paid to preventive and
y treatment of mental illness. Small hospitals and
pensaries are being built near railroad stations and in
ters of population throughout the Soviet Union for
poses of early treatment, and many cures are ob-
ned. A capacity of 100–150 beds is considered optimal
mental hospitals. Separate hospitals are provided for
dren and for epileptics. Nurses attend the patients
o do not require clinic care but do require care in
nes. Particular attention is bestowed on veterans
those who were under bombing. There are at present
ut 60,000 beds for chronic mental cases in the Soviet
ion but 100,000 are desired.

The value in securing mental and emotional health of
ditioning to kindness, security, and group solidarity
illustrated in a remarkable way at the Institute for
iatrics in Leningrad. This is a training school of
iatric medicine, offering a 6-year course from second-
school to graduation, and a postgraduate course of
months integrated with a children's hospital. There
about 2,000 students, mostly women, and about
00 child patients. The proportion of male students has,
wever, been increasing since the end of the war. Re-
rch, care, and teaching all proceed within the same
titution, and children long confined to the hospital
n have school in the wards. The director, M. A.
ndeleva, stressed the particular importance of kind-
s and understanding in working with children. During
siege of Leningrad the hospital was for months under
ect bomb- and shellfire. Five hundred stoves were
de and installed in the Institute to replace the central
ating, which was demolished by the bombing. During
summer vitamin needs were met by growing black-
ries, raspberries, etc. on the hospital farm and pre-
ing syrups from them. According to Dr. Mendeleva,
ere were no neuroses among the patients during all this
ne. This she attributed to the confidence of the
tients in those who cared for them, the calmness of the
ff, and the fact that nothing was ever permitted to
terrupt the routine.

Consideration of programs safeguarding mental health
the Soviet Union cannot be adequate without at least
ef reference to the care and training of children in
rseries, kindergartens, and schools. There was a con-
ous and successful effort to make every child feel se-
re in being wanted and loved and in having a place in
group. The older children also had a sense of re-
nsibility to their communities and took it as a matter
course that they would contribute to the needs of their
mmunities by active personal work. The excellent
ogram of child care makes possible active participation
work by women with families.

To what degree the conditioning of children to kind-
ss, group participation, and responsibility is traditional
and to what degree it is a conscious adaptation of psychological principles, we do not know. At all events, it impresses us as basically sound mental hygiene.

Communal Hygiene

The Institute of Public and Communal Hygiene in Moscow, which was founded in 1931 and included in the Academy of Medical Sciences in 1945, suffered a great deal during the war. Repair is still not complete, and equipping is under way. The Institute has 9 divisions and 12 laboratories as follows: (1) Division of Air Hygiene and Town Planning, in which there are two laboratories: Microclimate and Air Study; (2) Division of Water Hygiene, Water Supply, and Canalization, with two laboratories: Study of Drinking Water and Study of Sewer Water; (3) Division of Soil Hygiene and Purification of Towns, including two laboratories: Soil Study and Helminthological Study; (4) Division of Hygiene of Dwellings and Public Buildings, with its two laboratories: Lighting Hygiene, and Conditioning, Heating, and Ventilation; (5) Division of Personal Hygiene and Customs, in which there are two laboratories: Study of Clothing and Articles of Personal Hygiene; (6) Division of Bacteriological Sanitation, with a laboratory; (7) Division of Physiology, with a laboratory; (8) Division of Organization Methods, Consultation, and Examination; and (9) Division of Municipal Statistics and Legislation.

The Institute staff comprises 14 professors with the M.D. degree, 29 senior scientific workers, 22 junior scientific workers and specialists, 6 postgraduate students, 25 scientific auxiliary personnel, and 35 business personnel—131 persons in all. The director is A. N. Sysin.

The problems upon which the Institute works, as presented to us in writing by E. A. Bragin, the assistant director, are given below, together with some observations noted during our round of the laboratories.

(1) Sanitary consequences of the war: (a) re-establishment of Stalingrad—expedition into Stalingrad with a staff of 6 scientific workers; (b) dwellings in the re-establishment period; and (c) cleaning cities in periods of war and subsequent times.

A landscape architect was at work with large maps of Stalingrad, major buildings, parks, etc. Particular attention was being given to discovering the optimal relation of parks and recreation centers to the distribution of the population and to the planting of trees in the city. The design and location of buildings with respect to air currents and ventilation was under consideration. Formulation of optimal hygienic conditions in town planning is being sought. A book is now in press on the planting of trees in cities.

(2) Acclimatization: (a) population in Arctic conditions—expedition to Dikson Island with a staff of 3 persons; (b) clothing and conditions in different climatic zones.

Study of the influence of the microclimate of cities on persons is carried out by observation of the condition of meteorological factors in 5 points of the city of Moscow with meteorological statistics. The problem is an explanation of the hygienic problem of creation of the most suitable microclimatic conditions in different parts of the city, depending on the function of these parts, by means of planning and planting trees in the city. The laboratory establishes special methods for outer districts for the purpose of massive carrying out of observations.

The study of acclimatization of persons is carried out in different climates of the USSR by special programs, both for local institutes and also a special expedition into the Arctic. The expedition visits Dikson Island, Igarku and a series of points on the shore of the Karsky Sea. The study referring to conditions, morbidity and meteorological factors gives a great amount of material which has been obtained in these places in a series of years.

(3) Pollution of atmospheric air: (a) dust pollution in relation with meteorological factors and the significance of planting trees in the regions where the air is full of dust; (b) bacteriological pollution of the air and its sanitation.

The influence on the process of self-purification of air by filtration through planting trees is seen in different regions of Moscow and it is seen in places significantly covered with dust as well as those little covered with dust in different seasons of the year.

Studies are carried out on the characteristic processes of self-purification and pollution of air by the method of study of the loss of solar radiation and its specific participation depending on change in content of aerosols and micro-elements of the air medium.

A theory of normal pollution of the air is being developed for establishing different origins of pollution, for establishing city standards of planning for the purpose of different types of businesses.

Detailed studies are conducted with regard to fuels, wind velocity, humidity, temperature, etc. in relation to the smokes and fumes from specific installations in Moscow and Stalingrad and with regard to better methods of stoking, precipitation, etc.

We saw apparatus for the collection of dust on oiled slides supported in vertical and horizontal planes on a weather vane device, and a portable device containing batteries, fan, flowmeter, and cotton strainer for collecting and weighing dust.

With regard to ridding the air of confined spaces of its pathogenic microorganisms, work was proceeding along the lines in progress in the United States but was at a relatively early state of development in the Moscow laboratory. A simple infection chamber was available in which bacterial aerosols were sprayed and the killing action of ultraviolet radiation and germicidal vapors was under investigation. Vapor of fir balsam was reported to be germicidal and that of certain vinyl ethers bactericidal in a concentration of 0.1–0.2 mg./l. of air. "The activity (of this vinyl ether) is not found to be dependent on the humidity of the atmosphere, and therefore this preparation is preferred above triethylene glycol (Robertson)." A 6,000-volt electroprecipitator is reported to be sensitive detector of bacteria in air.

(4) Pollution and self-purification of water: (a) reservoi and sanitary conditions of them—expedition to Klyazminsk reservoir (water station) with a staff of 8 scientific worker (b) manufacture of sewerage water and its significance pollution of water.

Charts of bacterial counts of the Moscow water supp since 1937 indicated that these counts were high when t water was derived chiefly from the Moscow River b had been lower in recent years with water coming main from the Volga.

Stress was laid upon a method of bacteriological sam pling in which the water was filtered through a collodio membrane held in a filter of Seitz type. The membra was then removed, laid on the surface of an endo-ag plate, and incubated. *Escherichia coli* colonies of cha acteristic appearance grew out in the membrane. member of the staff described this and other "Russi methods" and said proudly, although with some em barrassment, that these were the reasons Americ standard methods of water analysis had not bee adopted.

(5) Sanitary indications of soil pollution.

In the laboratory of soil hygiene it was explained tha during the siege of Stalingrad and in other circumstance of prolonged deprivation of protein during the war, th colon bacillus flora of the feces of the human populatio was greatly reduced.[1] Many bacteria with typical bio chemical reactions of *Aerobacter aerogenes* appeared i the feces under these circumstances.

The work carried out in the Soviet Union and in part b the Institute of Hygiene indicates complete absence from so not polluted by persons or animals of both *A. aerogenes* an *E. coli*; and that either is an indication of some sort of pollu tion. Thermophiles are also used as indicator organisms fo animal and human fecal pollution. The thermophilic organism resulting from human fecal pollution have a lower tempera ture tolerance—up to 60° C.; those of some animal feces to erate 60° or above.

Detailed description of the studies of these labo ratories regarding sanitation, mineralization of organi matter, and microbic antagonisms in the soil will not b attempted here.

(6) New sources of lighting and their sanitary purpose

The Division of Hygiene of Dwellings and Public Buildin has existed in the Institute from the day of its beginning i 1931. The Division consists of: (a) laboratory for the hygien

[1] Those who have read Simonov's *Days and nights* may appreciate t spirit of people who investigate the intestinal flora under the appall conditions of Stalingrad.

pecial and artificial lighting; (b) laboratory for the hygiene eating, ventilation and air conditioning in which there are cial chambers for microclimate with the use of conditioned The staff of this Division is 14 persons. The chief of the ision is Professor S. I. Vetonkin, M.D.

The Division has as its basic problems the working out of ienic problems for scientific basic planning, outfitting improvement of dwellings and public buildings:

(a) Study of microclimate of reserved spaces (study of age buildings, air ventilation, large buildings, etc.). At the sent time there is experimental study of few-storied build- in Stalingrad, Moscow and abroad with the Division rking on hygienic problems of normal dwellings, inner out- ing and arrangement of dwellings in the post-war period pedition to Stalingrad and abroad).

(b) Study of climatic lighting and the physiological- ienic basis of the method and norm of natural and artifical hting of closed dwellings and open spaces. In the pre-war rs, the laboratory of hygiene of lighting worked on the stions of: (1) lighting of schools, (2) lighting of medical establishments, (3) lighting of dwellings and (4) climatic light in Moscow. In subsequent years the laboratory is attacking the study of new sources of light (luminescent lamp) in a hygienic relation—physiological-hygienic purpose of luminescent lamp of low pressure mercury arc and also sterilamp (bactericide).

In the current year one doctor completes a dissertation under the direction of the laboratory of hygiene of dwellings on the theme: "Hygienic basis for lighting schools"; besides this, post-graduate students have carried out dissertations in collaboration with the Division on the theme: "Hygienic requirements for lighting medical institutions."

(7) History of hygienic thought in the USSR until the Revolution and in Soviet times.

(8) Network of scientific study and sanitary-prophylaxis establishments in the USSR.

(9) Home and municipal legislation in relation to sanitation and further perspectives.

(Continued in next week's issue.)

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History and Philosophy of Science (L): Raymond J. Seeger, Bureau of Ordnance, Navy Department, Washington, D. C.

Engineering (M): Frank D. Carvin, Newark College of Engineering, Newark, New Jersey

Medical Sciences (N): Malcolm H. Soule, University of Michigan, Ann Arbor, Michigan

Agriculture (O): Ernest E. DeTurk, University of Illinois, Urbana, Illinois

Education (Q): Dean A. Worcester, University of Nebraska, Lincoln, Nebraska

Chemical Research Conferences, 1947:

Colby Junior College, New London, New Hampshire, June 16–August 22

W. George Parks, *Direc*
Rhode Island State College, King

THE CHEMICAL RESEARCH conferences, organized on a continuous basis by Dr. Neil E. Gordon in 1938 and formerly known as the Gibson Island Research Conferences, are sponsored by the AAAS. Gifts from industrial companies whose laboratories have been represented at the Conferences provided the funds with which the AAAS purchased the Conference property on Gibson Island, located in Chesapeake Bay a few miles south of Baltimore, Maryland.

During the past nine years the Conferences have been held each summer on Gibson Island, the facilities of the Gibson Island Club being made available to those attending. However, in recent years it has not been possible to provide satisfactory accommodations for the increased number of persons desiring to attend the Conferences because of the limited facilities available and because of the expanding activities of the Club, which required greater use of its facilities for Club members.

The Management Committee of the Conferences therefore decided this year to dispose of the Gibson Island property and to move to a location with greater facilities and more suited to the specific needs of the group.

Location

The Chemical Research Conferences for 1947 will be held at the Colby Junior College, located in the New England vacation country, in New London, New Hampshire. The entire facilities of the College have been made available for the Conferences. Concord, the state capital, is 35 miles to the southeast, and Hanover is the same distance to the northwest. By automobile, New London is located on the cross-state highway, Route 11, 100 miles from Boston and 130 miles from Springfield, Massachusetts. The White Mountains are approximately 50 miles from the College.

There are two ways of reaching the College by train: From Boston, those attending the Conferences should take the Boston and Maine Railroad to Potter Place, which is a short distance by automobile from New London; from New York City and the West, New London is reached via Springfield, Massachusetts, and Claremont Junction, New Hampshire. Concord, New Hampshire, is the nearest airport and is served by the Northeast Airlines. Limited bus transportation is also available. The College owns and operates three station wagons, primarily for transportation to and from the railr stations.

There are six mountains in the skyline and numer lakes in the immediate area. Opportunities are availa for many sports, including golf (Lake Sunapee G Course), tennis (six composition courts and a pract board), swimming (fresh water), and boating. Numer other recreational facilities are available for relaxat during the Conferences.

Purpose

The Chemical Research Conferences were establish to stimulate research in universities, research foun tions, and industrial laboratories. This purpose achieved by an informal type of meeting consisting scheduled lectures and discussion of topics of curr research interest.

The first meeting of each Conference is held Monday 10:00 A.M. Other morning sessions through Friday usually scheduled from 9:30 A.M. to 12:00 Noon. T second session of each day is generally held from 7:30 10:00 P.M., Monday through Thursday. There no Friday evening sessions, and Conference members expected to release their rooms not later than Sun morning.

Attendance

Those interested in attending the Conferences requested to send in their applications to the director, or before April 15. Each applicant must state the insti tion with which he is connected and the type of work which he is most interested.

The director will submit the names of those reques attendance to the chairmen of the respective Conferenc Each chairman, in cooperation with a Program Co mittee, will review the names and select the member an effort to distribute the requests as fairly as possi among the various institutions represented. Na selected by the program committee will be returned the chairman to the director, who will notify th selected. A registration card will be sent with the notice selection. For each Conference advance registration mail is required. On receipt of the registration card a the registration fee of $3.00, made payable to the Che cal Research Conferences, a room assignment will be s to each registrant. In addition to the registration fee

osit to cover the room rent for the number of days attendance must accompany the registration card. oms are $4.00 per day per person; the meals served in College dining room, $4.50 per day per person. ring each Conference a buffet dinner is planned for rsday evening at no additional charge. If possible, e rooms will be made available for the speakers at the e rate. Several suites will be available at the rate of 00 per day per person, with a minimum of two persons suite. Unallocated suites will be assigned to man and e whenever possible. On proof that the member is ing his own personal expenses, he may be granted a ction of $1.00 per night on room rent. This informa- should be given at the time a request for attendance is made. The registration fee will not be refunded. The deposit to cover the room will be returned and room reservation canceled, provided notice of inability to attend is received in sufficient time to rent the room.

Accommodations will be available for a limited number of women who wish to accompany their husbands. All such requests should be made at the time of the request for attendance, since these limited accommodations will be assigned in the order of receipt of specific request.

Requests for attendance at the Conferences or for any additional information should be addressed to Dr. W. George Parks, Department of Chemistry, Rhode Island State College, Kingston, Rhode Island.

PROGRAM

Organic High Polymers

C. C. Price, Chairman; W. O. Baker, Vice-Chairman

June 16 C. S. Marvel, "New Monomers"; R. L. Frank, ucture of Synthetic Rubbers."

June 17 G. S. Whitby, "Proliferous Polymerization"; Rehner, Jr., "The Polyisobutylene Reaction."

June 18 A. J. Warner, Federal Telecommunication Labor- ies, "New Monomers"; H. Mark, "Cyclo-octotetraene."

June 19 A. V. Tobolsky, "Aging and Degradation of ymers"; E. H. Farmer, British Rubber Producers Associa- (title to be announced).

June 20 M. G. Evans, The University, Leeds (tentative).

Catalysis

ler G. Frankenburg, Chairman; H. S. Taylor, Vice-Chairman

June 23 Aristid V. Grosse, "The Concept of Catalytic emistry"; H. S. Taylor, "New Data on the Heterogeneity of talytic Surfaces."

June 24 James B. Sumner, "The Chemical Nature of catalysts; Problems Concerned With the Isolation of ymes"; Paul H. Emmett, "Adsorption of Carbon Mon- de and Hydrogen on Carbided Iron Catalysts."

June 25 Otto Beeck, "Thermodynamic and Mechanical istical Aspects of Catalysis"; Thomas W. DeWitt, "Mech- m Studies with C^{14} on Iron Fischer-Tropsch Catalysts."

June 26 M. Jellinek, I. Fankuchen, R. Ward, and M. hak, "X-Ray Diffraction in the Study of Catalysts" tative); Marion Armbruster, "The Sorption of Gases on a e Surface of Stainless Iron-Chromium-Nickel Alloys at 78°, and −185°C."

June 27 Herman E. Ries, Jr., "Adsorption Studies of e Supported Catalysts and Their Supports."

Petroleum

W. G. Lovell, Chairman; O. Beeck, Vice-Chairman

June 30 F. D. Rossini, "Hydrocarbons in Petroleum"; S. Kurtz, "Analysis of Petroleum Products for Hydrocarbon Types."

July 1 H. M. Smith, "Survey of Composition of American Petroleums"; A. C. Fieldner, "Synthetic Fuels and Shale Oil."

July 2 Clark Goodman, "Physical and Chemical Changes Produced by Nuclear Radiations"; A. M. Rothrock, "Power Production From Petroleum."

July 3 J. R. Bowman, "Theory of Distillation and Related Separation Processes"; Manson Benedict, "Diffusion Separation Processes."

July 4 O. Redlich, "Azeotropic and Extractive Separations."

Textiles

W. A. Sisson, Chairman; Ross C. Whitman, Vice-Chairman

July 7 Eugene Pacsu, "The Molecular Structure of Cellulose and Its Relationship to Chemical Degradation"; Clifford B. Purves, "Some Aspects of the Chemical Reactivity of Cellulose."

July 8 Onslow B. Hager, "The Reaction of Cellulose With Formaldehyde Compounds and Its Effect on Fiber Properties"; John A. Howsmon, "The Fine Structure, Moisture Regain, and Physical Properties of Rayon."

July 9 Alfred E. Brown and Milton Harris, "Natural Protein Fibers"; Harold P. Lundgren, "Synthetic Protein Fibers."

July 10 Charles F. Goldthwait, "The Swelling of Cotton and Its Utilization in Water-resistant Fabrics"; Harold DeWitt Smith, "Properties of Woven Fabric as Anticipated From Fiber Properties."

July 11 Earl K. Fischer and Charles H. Lindsley, "Rheological Properties of Compositions Used in the Textile Industry."

Corrosion

K. G. Compton, Chairman; I. A. Denison, Vice-Chairman

July 14 H. H. Uhlig, "The Electrochemical Theory of

Corrosion"; R. B. Mears, "Factors Affecting the Rate of Atmospheric Corrosion."

July 15 W. S. Loose, "Atmospheric Corrosion of Light Metals"; R. H. Brown, "Atmospheric Corrosion of Light Metals"; A. W. Tracy, "Atmospheric Corrosion of Nonferrous Metals"; W. E. Campbell, "Indoor Atmospheric Corrosion of Nonferrous Metals."

July 16 Harry R. Copson, "Atmospheric Corrosion of Iron and Ferrous Alloys"; C. H. Sample, "Atmospheric Corrosion of Metallic Protective Coatings."

July 17 I. A. Denison, "Underground Corrosion"; R. B. Hoxeng, "Cathodic Protection of Underground Structures by Means of Light Metals."

July 18 R. L. Starkey, "Bacteria and Underground Corrosion."

Medicinal Chemistry

E. H. Northey, Chairman; J. M. Sprague, Vice-Chairman

July 21 Enzyme Chemistry.

July 22 Antibiotics.

July 23 Curare and Curare-like Drugs; Folic Acid.

July 24 Veterinary Medicine.

July 25 Tuberculosis.

The speakers and titles on the Conference subjects will be announced in the final program, to be published April 1, 1947.

Vitamins

D. W. Woolley, Chairman; Floyd S. Daft, Vice-Chairman

July 28–August 1 P. L. Harris and E. L. Hove, "Treatment of Experimentally Induced Stomach Ulcers With Tocopherol"; H. R. Bird, "Studies on an Unknown Growth Factor in Cow Manure"; C. A. Cary and A. M. Hartman, "I. Evidence of the Existence of a Still Unidentified Growth Factor in the Nutrition of the Rat. II. Relation Chemically and Nutritionally to Protein, and Occurrence in Variously Prepared Caseins and Other Sources of Protein"; W. E. Knox, "Identification of New Metabolites of Nicotinic Acid"; D. M. Bonner, "The Precursors in the Biosynthesis of Nicotinic Acid"; J. Schultz and G. T. Rudkin, "The Requirements for Growth of *Drosophila* on a Chemically Defined Medium"; W. D. Salmon, D. H. Copeland, and R. W. Engel, "Production of Neoplasms as a Result of Prolonged Choline Deficiency."

The program for the Conference on Vitamins is incomplete. Additional speakers with titles and the specific dates will be given in the final program, to be published April 1, 1947.

Food and Nutrition

Lawrence Atkin, Chairman; P. L. Harris, Vice-Chairman

August 4–August 8 M. L. Anson, "Sugar-Protein Reaction, Significance and Methodology"; Speaker to be announced, "Chemistry of the Sugar-Protein Reaction"; D[iscussion] leader, J. P. Kass. Speaker to be announced, "P[roteins] Anti-Oxidants, Fat-Soluble"; Speaker to be announced, "P[roteins] Anti-Oxidants, Water-Soluble"; Discussion leader, P. Harris. Gerald J. Cox, "Caries and Nutrition in Human S[ubjects]"; James H. Shaw, "Nutrition and Animal Dentition"; Discussion leader to be announced. K. P. Richter, "S[election] Selection of Foods"; H. Waelsch, "Nutrition and Brain F[unction]"; Discussion leader, to be announced. A. White, "[Nu]trition and Endocrine Function"; Paul György, "Diet, Li[ver] and Sex Hormones"; Discussion leader to be announc[ed]. Speaker to be announced, "Intestinal Microorganisms [in] Human Nutrition"; L. Wright, "Intestinal Microorganis[ms] and Animal Nutrition"; Discussion leader to be announc[ed]. Speaker to be announced, "The Clinical Estimation of Nu[tri]tional Status"; Speaker to be announced, "Results of Post[war] Nutritional Surveys"; Discussion leader to be announc[ed]. D. K. Tressler, "Enzymes in the Food Industry"; Z. I. K[er]tesz, "Pectins and Pectic Enzymes"; Discussion leader to [be] announced. H. H. Mitchell, "Evaluation of Proteins [by] Hydrolysates *in Vivo*"; R. J. Block, "Evaluation of Prot[eins] and Hydrolysates *in Vitro*"; Discussion leader, D. Melnick.

The completed program for the Food and Nutrition C[on]ference will be published April 1, 1947.

Cancer

A. M. Brues, Chairman; Paul S. Henshaw, Vice-Chairman

The preliminary program for the Cancer Conference is [not] yet available. The final program will be published April 1947.

Instrumentation

C. O. Fairchild, Chairman; J. C. Peters, Vice-Chairman

August 18 Robert B. Jacobs, "High-Vacuum Measu[re]ment and Control"; R. L. Garman, "Physical Properties [Not] Commonly Used in Indirect Measurement"; C. M. Albrig[ht], Jr., and C. H. Neilsen, "Unsolved Control Problems of [the] Chemical Industry."

August 19 Ralph H. Müller, "Electronics in Modern An[a]lytical Chemistry"; Donald P. Campbell, "Practical Appli[ca]tion of Automatic Control Theory; Ralph E. Clarri[dge] "The Organization and Functions of an Application Engine[er]ing Department."

August 20 Norman Wright, "Application of Infra[red] Measurements in Industry"; John J. Grebe, "Application [of] Control Principles to Human Behavior."

August 21 James J. Lingane, "Polarography"; J. [P.] Mouzon, "Low-Temperature Radiation Pyrometry in Indu[s]try."

August 22 W. J. Eckert, "Field of Usefulness of Vari[ous] Mechanical and Electrical Calculators."

NEWS
and Notes

Late Friday, March 7, the Inter-state and Foreign Commerce Committee of the House ended the current hearings on the National Science Foundation Bills. A score of witnesses presented testimony, some urging that the four House Bills, 1815, 1830, 1834, and 2027, which are identical with the Senate measure, S. 526, analyzed last week in *Science*, be adopted. Others, particularly those representing the administration, seemed to favor the Celler Bill, H.R. 942, calling for a single responsible officer appointed by the President.

One witness, Frank B. Jewett, advised against any Foundation. He said that the present shortage of private funds for fundamental research in the sciences was only temporary, due to the existing tax structure, and that he thought that a small change in the tax laws would make private funds again available in sufficient amounts. In taking a position against the Foundation he continued his stand of a year ago in the Senate hearings as the only person to testify against some form of Federal subsidy for research.

When asked by the Committee specifically about this solution, President Conant replied that he thought it was "indirect" and that immediate measures should be taken to discover scientific talent among young people and to provide for their basic science education through scholarships.

President Conant also said that he thought there had been entirely too much concern over the proposed organization and administration of the bills, that he personally would be satisfied to see any of them made a law. He held that the patent issue was separate and should not be a part of final congressional action. He also preferred the wider latitude permitted in the four identical bills, where the social sciences are not specifically mentioned but the Board is permitted to increase the number of Divisions to include "other sciences."

The questions of the Committee were designed to get clear statements on the controversial points: type of administration, single administrator or board; patent provisions; and inclusion of the social sciences. To a lesser extent questions were directed to finding out whether witnesses favored some mandatory geographical distribution of funds.

The complete testimony from the official record will not be available for some time, so that an analysis of each witness's stand on these controversial points cannot now be made. In some cases no clear-cut classification will be available even then, because some witnesses avoided a direct answer to the question.

Others among those who testified were Edmund E. Day, representing the newly-formed Inter-Society Committee for a National Science Foundation (Science, March 7); Robert Patterson, Secretary of War; Adm. P. F. Lee, director, Office of Naval Research; Thomas Parran, Surgeon General; Caroll L. Wilson, representing the Atomic Energy Commission; William C. Foster, Undersecretary of Commerce; Detlev Bronk, National Research Council; Randolph T. Major, director of research and development, Merck & Company, Inc.; Robert M. Yerkes, Social Science Research Council; Bruce Brown, Standard Oil of Indiana; John F. Victory, National Advisory Committee for Aeronautics; W. A. Higinbotham, Federation of American Scientists; Vannevar Bush, Joint Army-Navy Research Board; and George E. Folk, National Association of Manufacturers.

Statements from Representatives Celler and Mills, Isaiah Bowman, and Homer Smith were inserted in the record without reading.

Following an all-day meeting of the Executive Committee of the new Inter-Society Committee for a National Science Foundation, March 5, Dael Wolfle, secretary-treasurer, announced that Isaiah Bowman and W. Albert Noyes, Jr. had found it impossible to serve as members of the Committee. The remaining members, Edmund E. Day, Harlow Shapley, Ralph W. Gerard, and R. G. Gustavson, unanimously agreed on the following statement, which became part of Dr. Day's testimony at the House hearing, March 6:

(1) The Foundation must provide for the support of basic fundamental research without reference to the development of immediate practical applications.

The many striking applications of technology during the war tend to give a misleading impression of the progress of science. Wartime "discoveries," such as radar, magnetic detection of submarines, and even the atomic bomb, were simply the exploitation of long-established scientific principles. Radar, for example, is a straightforward modification of radio. And radio is the practical use of the discoveries made by Hertz in the middle of the last century. During the war virtually all basic research came to a halt as scientists and laboratories concentrated on engineering and development for immediate uses. We must have a National Science Foundation to replenish our stockpile of basic scientific knowledge.

(2) The Foundation should be free to investigate problems in any scientific area and by any appropriate method, for it is impossible to determine in advance which problems will lead to fruitful results and which methods will be successful.

Twenty years ago who would have thought that the study of molds would lead to the development of the wonder drug, penicillin? Fifty years ago, in searching for the missing element, radium, Madam Curie had no thought or foreknowledge of its many useful applications.

(3) The Foundation should provide for the training of young scientists to make up the great shortage of scientific personnel that now exists due largely to the fact that students who would normally have begun their scientific careers were taken for military duty.

(4) The Foundation should provide for the coordination of scientific research and the development and utilization of scientific personnel. It should integrate its work with that of other government agencies, should be free to plan the development of new laboratories when necessary, and should become responsible for the continuation of the National Roster of Scientific and Specialized Personnel. The Foundation should feel a responsibility and have authority to survey continuously the country's scientific needs and assume leadership in planning ways to meet those needs.

The administrative machinery necessary to accomplish these aims was one of the controversial points in the bills considered last year. There is no unanimity of opinion among scientists as to the most desirable administrative setup. The specific organization should be planned with the help of experts in government and

administration. There is a very widespread feeling among scientists that the caliber of men chosen to direct the National Science Foundation is much more important than the details of administrative organization. It is our feeling that the bill should not be so specific in details of procedure and organization as to hamper the administration in carrying out the objectives of the Foundation. Competent administrators, well acquainted with scientific problems and with the full confidence of the Government and their scientific colleagues, can create an effective National Science Foundation.

President Conant's testimony, which will be printed in full in *Science* next week, centered about the following points:

(1) The welfare of a free society in an industrial age depends on a continuous advance of science and the application of the new knowledge to useful ends.

(2) Both the advance of science and the application of science to industry, to medicine, and to agriculture depend on the quality and quantity of scientists and engineers available in a nation.

(3) The supply of men depends on the number trained and the innate ability of those who undertake the special training.

(4) The scientific professions in question require a long and expensive education beyond high school.

(5) This education is of such a nature that it can be given at only a relatively few centers in every state.

(6) Therefore, unless a student lives in one of these centers, his professional training must be costly, for he must pay for room and board away from home as well as other expenses.

(7) The consequent financial barrier now prevents many boys and girls of high ability from going on with an advanced education. Much talent is lost to the Nation by this educational waste.

(8) To right the balance, a Federally-supported scholarship and fellowship program is required.

President Truman paid a surprise visit to the project exhibits of the 40 contestants in the 6th Science Talent Search, Saturday, March 1. The President appeared at the Statler Hotel at the dinner hour. Refusing to interrupt the dinner, he spent a half-hour in the company of his aides viewing the exhibits. The President specifically requested officials to provide him with a detailed report on the present whereabouts and status of the winners of the previous five Searches conducted annually under the auspices of Science Service for the Westinghouse Science Scholarships.

About People

Walter M. Gilbert retired on March 1 as executive officer of the Carnegie Institution of Washington after 42 years of service. Since 1905, three years after establishment of the Institution, he has been a central figure in the operational and administrative conduct of its affairs. During the war years he served as representative of the Institution in its contractural relationships with government agencies.

The new executive officer is Paul A. Scherer, formerly chief of the engineering and transition office, OSRD.

Henry W. Smyth, professor of physics, Princeton University, is presenting a summary of progress in atomic physics during the past half-century, in connection with the Sigma Xi National Lectureships, during March. Following are the universities at which he will speak and the dates: Baylor University, March 25; Tulane University, March 26; and The University of North Carolina, March 28. On March 3, 5, 6, and 7 Dr. Smyth spoke at the University of Nevada, Brigham Young University, University of Utah, and Utah State Agricultural College, respectively.

William E. Rand, Sun Chemical Corporation, New York, has been appointed assistant director of the Stanford Research Institute, Stanford University, California. He will also act as project manager for the Natural Rubber Research Project being conducted by the Institute for the Office of Naval Research.

Mary Evans Maxfield, assistant professor of physiology, Mt. Holyoke College, has been appointed to the staff of the Department of Pharmacology and Therapeutics, Wayne University College of Medicine, Detroit, Michigan.

Barry Commoner, medical and biological editor of *Science Illustrated* since May 1946, has resigned from th editorial staff.

Norman Q. Brill has been appointe professor and director of the Departmen of Neurology, Georgetown Universit School of Medicine, Washington, D. C Dr. Brill, who taught at Columbia Un versity and engaged in private practic in New York before the war, is at presen consultant and assistant chief of neur psychiatry, Veterans Administration Washington, D. C.

William Roger Sloat, televisio engineer, Columbia Broadcasting Syste New York, has been appointed instructo in engineering, Institute of Geophysic Technology of St. Louis University.

W. E. Carroll, head of the Universit of Illinois Department of Animal Hus bandry since 1939 and member of th Agricultural College staff since 192 has been appointed associate direct of the Agricultural Experiment Statio He will be responsible for coordinatio and routine administration of sever hundred research projects under wa at the Station.

Clarence A. Discher, formerly acti head of the Chemistry Departmen Oshkosh, Wisconsin, State Teachers Co lege, has been appointed assistant profe sor of chemistry, Rutgers College Pharmacy.

H. H. Remmers, director, Divisio of Educational Reference, Purdue Un versity, Lafayette, Indiana, has accepte an invitation to lecture on education measurement and evaluation in the sum mer session of the University of Britis Columbia, Vancouver, July 2–August 1

R. B. Cattell, chief surgeon of th Lahey Clinic, Boston, and W. E. Gall professor of surgery, University of To ronto, recently addressed members of th University of Texas Medical Branch Galveston, Texas.

Virginia C. Dewey, formerly of th chemical research staff of Lever Brother Cambridge, Massachusetts, is now re search associate in microbiology at Am herst College, Amherst, Massachusett

James O. Foley has been made pr fessor of anatomy and chairman of th department, Medical College of Alabam Birmingham, Alabama. Dr. Foley went Alabama from Tulane University, whe

had been from 1925 through 1930. He places C. N. Goss, who recently went to Louisiana State University School of Medicine as chairman of the Department of Anatomy.

Clarence J. Hylander, former staff officer with the Naval Air Training Command and head, Botany Department, Colgate University, has joined the Macmillan Company as visual aids editor in their College Department.

Alfred S. Romer has been appointed Alexander Agassiz professor of zoology at Harvard University. Director of the Museum of Comparative Zoology, curator of Vertebrate Paleontology, and professor of zoology, Prof. Romer joins Henry B. Bigelow, curator of Oceanography, and Frank M. Carpenter, curator of Fossil Insects, who also held Agassiz professorships, established in 1844 under the will of Alexander Agassiz, who was in charge of the Museum of Comparative Zoology until his death in 1910.

James Bordley, III, associate professor of medicine, Johns Hopkins University School of Medicine, has been appointed director of the Mary Imogene Bassett Hospital, Cooperstown, New York, to succeed George M. Mackenzie. Dr. Mackenzie, for 20 years physician-in-chief and director of the hospital, will retire September 1, 1947.

Francis E. Johnstone, Jr., professor of horticulture and vegetable breeder, Alabama Polytechnic Institute, Auburn, has been appointed geneticist for the Educational Service of the National Cottonseed Products Association. Dr. Johnstone, who has been associated with the Institute since 1940 except for wartime service in the Navy, will cooperate with research institutions in encouraging production of cotton high in oil content and other oilseed crops in cotton states.

Hobart M. Smith, Department of Fish and Game, Texas A. and M. College, College Station, has been appointed assistant professor of zoology at the University of Illinois, Urbana.

Ralph L. Shriner will become professor and head of the division of organic chemistry, Department of Chemistry, State University of Iowa, Iowa City, in September 1947. He is now chairman of the Department of Chemistry, University of Indiana, Bloomington, a post he has held since 1941.

Grants and Awards

The Federated Societies for Experimental Biology will grant five travel awards of $500 each to younger scientists in the physiological field who wish to present papers before the 17th International Physiological Congress at Oxford, England, July 22–25. Awards will be made to scientists 35 years of age or younger, who submit outstanding contributions in physiology for presentation.

Membership in one of the Federated Societies will not influence selection for an award. Until March 22 applicants may address letters to Maurice B. Visscher, Secretary, American Physiological Society, 318 Millard Hall, University of Minnesota, Minneapolis 14, enclosing seven copies of an abstract of his or her paper and an equal number of copies of a curriculum vitae and bibliography. Applicants should also send the names of two to four scientists competent to evaluate their work.

The Agricultural and Mechanical College of Texas, College Station, Texas, has received the following research grants: $6,000 for two research fellowships from the Heil Company, Milwaukee, Wisconsin, and gift of a portable dehydration unit for hay and grain drying and a mechanical harvester; $15,000 from Swift & Company to the Texas Agricultural Experiment Station for support of a three- to five-year study supplementing investigations initiated by the Station and the U. S. Department of Agriculture on methods of applying phosphorus to cattle by application of fertilizers and by feeding; $5,000 from John W. Carpenter, Dallas, Texas, for work on artificial insemination of dairy cattle; and $250 from the Texas Restaurant Foundation to assist students in commercial dietetics at Prairie View University for Negroes, a branch of Texas A. & M.

C. Clayton Hoff, assistant professor of zoology and parasitology, Colorado A. & M. College, has been awarded a grant of $200 by the American Academy of Arts and Sciences for ecological work on plant and animal associations at various altitude levels in Colorado.

The Roscoe B. Jackson Memorial Laboratory has received a grant of $15,000 from the John and Mary R. Markle Foundation to be used over a two-year period for developing electronic devices for measurement of emotional and physiological reactions. The work will be in charge of John L. Fuller.

Fellowships

Battelle Memorial Institute, Columbus, Ohio, has announced openings for a limited number of predoctoral Fellows and postdoctoral Associates to conduct scientific and engineering investigations in Battelle laboratories during the year beginning in the summer or fall of 1947. Appointees will devote full time to their own research projects in Battelle laboratories under the guidance of the Battelle technical staff.

Fellowships are open to men seeking the Doctor's degree in a science or engineering and are available normally for the final year of graduate study. Fellows receive a stipend of $1,200 a year plus allowances for supplies, equipment, traveling, and other expenses.

Associateships are open to young men who have completed their academic training and have shown exceptional aptitude for research as graduate students or in subsequent employment. The stipend of an Associate is adjusted to his preparation, experience, and promise.

Inquiries may be addressed to the Institute, 505 King Avenue, Columbus 1, Ohio.

General Electric Company recently granted research fellowships totaling $20,500 to 14 graduate students for advanced study in electricity, physics, physical chemistry, and engineering.

The American Telephone and Telegraph Company has awarded 1947–48 Frank B. Jewett fellowships for research in the physical sciences to the following: M. G. Ettlinger, California Institute of Technology, also a 1946–47 fellow, in chemistry; Wallace D. Hayes, California Institute of Technology, physics; Paul Olum, Harvard University, mathematics; Aadne Ore, Yale University, physics; Alfred Schild, Carnegie Institute of Technology, physics; Robert L. Scott, University of California, also a 1946–47 fellow, chemistry; and Edwin H. Spanier, University of Michigan, mathematics.

The fellowships, founded three years ago on retirement of Dr. Jewett, vice-president in charge of development and research, carry an annual stipend of $3,000 to the holder and $1,500 to the resident institution, and are normally available only to scientists who have recently received doctorates or are about to receive them.

The University of Maryland has been granted a fund by the Bartlett Tree Research Laboratories, Stamford, Connecticut for study of nematode diseases of ornamental plants. The grant will provide a graduate assistantship in the Department of Botany beginning July 1.

Colleges and Universities

The University of Rochester Division of Engineering, Rochester, New York, announces the following new administrative appointments: John H. Belknap, chairman of the Department of Electrical Engineering; Howard G. Gardner, chairman, Department of Chemical Engineering; and Horace W. Leet, chairman, Department of Mechanical Engineering. The Division of Engineering, created in 1945 as an expansion of the former Department of Engineering, has an enrollment of 400 students, nearly double the prewar number.

A new $500,000 Navy research contract for the development of a synchrotron was announced by Edmund E. Day, president of Cornell University, March 5. The new instrument is to be housed in a small structure north of Bailey Hall, adjoining the proposed new building for the Laboratory of Nuclear Studies. The new synchrotron will be approximately 12 feet in diameter and contain nearly 70 tons of special transformer iron. It is expected to accelerate electrons to 300,000,000 electron volts, sufficient to produce mesons.

Meanwhile, new methods of studying high-energy particles are being developed at the Cornell Laboratory as completion of the synchrotron is awaited. It is hoped that some of these may be tested in cosmic-ray study before the machine is ready for use.

The production and study of mesons is only one of the experiments planned for the synchrotron. Experimental verification of some of the present theories making conflicting predictions about the behavior of electric forces in the ultra-high energy region will be possible.

Researchers at present are making use of the slow neutron velocity-measuring equipment, again in operation with the Cornell cyclotron after being loaned to the Los Alamos Laboratory. New results have been obtained recently on the scattering of slow neutrons in water.

A new staff of physicists has been assembled at the University's Laboratory of Nuclear Studies. In addition to Director Robert R. Wilson (*Science*, February 21), others include Hans A. Bethe, recently head of the Theoretical Physics Division, Los Alamos; Lloyd P. Smith, now chairman of Cornell's Departments of Physics and Engineering Physics, and associate director of the RCA Laboratories, Princeton, during the war; L. G. Parratt, formerly head of the Engineering Division Research Unit, Naval Ordnance Laboratory; K. I. Greisen, of the Los Alamos staff; B. D. McDaniel, of the Radiation Laboratory, M.I.T.; Richard P. Feynman, formerly of Princeton, and a group leader in the Theoretical Physics Division, Los Alamos; Philip Morrison, senior physicist at the Metallurgical Laboratory, Chicago, and at Los Alamos; and Dale R. Corson, of the Radiation Laboratory and the Los Alamos staff. New research associates are Charles P. Baker, Ernest D. Courant, John W. DeWire, and Charles D. Swartz, all of whom had important wartime assignments.

Franklin A. Long, of the Cornell Department of Chemistry, who has returned after three and one-half years with OSRD, will also be a member of the group. Other additions to the staff are expected. Robert F. Bacher, former head of the Laboratory of Nuclear Studies, is presently serving on the U. S. Atomic Energy Commission (*Science*, November 8, December 13 and 20).

Industrial Laboratories

Eli Lilly and Company, Indianapolis, Indiana, has appointed the following to the Research and Control Function: Royce Buck, University of Minnesota, Analytical Department; Ralph Truax, Purdue University, Antibiotics Manufacturing Division; and Mary Jane Ward, Iowa State College, Organic Chemistry Division.

Bausch & Lomb Optical Company announces opening of a manufacturing plant at Wellsville, New York, and purchase of the four-story Navy Building on Champeney Terrace, Rochester, New York, as part of its $6,000,000 modernization program. At present 400 employees are producing eye-glass lenses and television optics in the Navy Building, which was leased to Bausch & Lomb during the war.

E. I. du Pont de Nemours & Company, Wilmington, Delaware, has announced the following organizational changes in the Technical Division of the Rayon Department: Hood Worthington, assistant director, Engineering Research Section, Wilmington, was made assistant director, Nylon Research Section, Wilmington, and W. L. Hyden, assistant director, Cellophane Research Section, Buffalo, New York, was promoted to director of personnel, planning, development, and patent service, Wilmington.

Other appointments are: F. H. Swezey, senior research associate, acetate process rayon plant, Waynesboro, Virginia; G. P. Hoff, director of acetate research, and G. M. Karns, director of cellophane research, Wilmington; W. W. Heckert, director, and E. W. Spanagel, assistant director of cellophane research, Buffalo; W. C. Eberlin, assistant director of new fibers research, Waynesboro; C. E. Miller, manager of cellulose acetate research, Waynesboro; R. A. A. Hentschel, manager of pioneering research, Buffalo; F. R. Millhiser, manager of viscose rayon research, Richmond, Virginia; and R. F. Conaway, assistant director of the Acetate Research Section, Waynesboro.

Meetings

The Southeastern Section of the Botanical Society of America, Inc., will hold its 4th annual meeting at Emory University, Georgia, April 18–19, with the Association of Southeastern Biologists and the Southern Appalachian Botanical Club.

The Federation of American Societies for Experimental Biology will meet in Chicago beginning May 18, William H. Chambers, Federation secretary-treasurer, has announced. The Federation is composed of the American Physiological Society, American Society of Biological Chemists, American Society for Pharmacology and Experimental Therapeutics, American Society for Experimental Path-

ology, American Institute of Nutrition, and American Association of Immunologist.

The Pittsburgh Geological Society will hold a symposium on the Trenton and Sub-Trenton strata of the Appalachian Area May 16 at the William Penn Hotel, Pittsburgh. Papers will be presented at morning and afternoon sessions, and a banquet will be held in the evening.

The purpose of the symposium is to bring together all information possible on the Trenton and Sub-Trenton rocks of the Appalachian Basin from the surface section on the eastern and northwestern outcrop belt to the subsurface section across the Basin as interpreted by well records and sample studies. The stratigraphy, structure, and economic aspects of this portion of the geological column will be correlated for the entire Appalachian Basin.

John T. Galey is chairman of the symposium committee.

Elections

The Oregon Academy of Science elected the following officers at its 5th annual meeting in Portland, Oregon, January 17–18: R. R. Huestis, Eugene, president; Warren D. Smith, Eugene, vice-president; F. A. Gilfillan, Corvallis, secretary; and Pierre Van Rysselberghe, Eugene, treasurer.

The southern section of the American Society of Plant Physiologists elected the following officers for 1947: O. A. Leonard, Mississippi State College, chairman; Ivan E. Miles, North Carolina Department of Agriculture, vice-chairman; and Henry C. Harris, Florida Agricultural Experiment Station, secretary-treasurer. H. P. Cooper, Clemson College, South Carolina, E. M. Emmert, University of Kentucky, and S. F. Thornton, Norfolk, Virginia, were elected members of the executive committee.

A new insecticide, TEP, which will kill some important insect pests not affected by DDT, has been announced by Leo R. Tehon, acting chief, Illinois Natural History Survey.

Disclosure was made by George F. Ludvik, working in the Natural History Survey laboratories on a Monsanto Chemical Company fellowship under George C. Decker, entomologist of the Natural History Survey and the Illinois Agricultural Experiment Station.

The new insecticide, tetraethyl pyrophosphate, which for brevity can be shortened to TEP, has been unusually effective in laboratory tests against aphids and mites, destructive crop pests difficult or impossible to control by DDT. The shortage of nicotine, the poison usually relied upon for control of aphids on peas, apples, potatoes, peaches, and other crops, makes discovery of TEP especially important at this time, Dr. Decker pointed out. Laboratory tests indicate that it is more than 10 times as toxic to aphids as nicotine alkaloid.

TEP was discovered in studying an extensive series of phosphorus compounds. It has been found to be approximately three times as toxic to insects as hexaethyl tetraphosphate, an insecticide developed by the Germans during the war as a substitute for nicotine.

An advantage of TEP, Dr. Decker explained, is that it does not appear to leave a poisonous residue. Tests being conducted indicate that this product will decompose within a few days after application, and food products on which it is used may not need to be washed before marketing.

Before being employed on the Monsanto research project, Mr. Ludvik served 40 months in the Army Medical Corps. He was graduated and received his Master's degree from the University of Illinois and is continuing graduate study and research on insect pests of crops.

A letter from Oscar Orias, Córdoba, Argentina, indicates that a private institution for research in the fundamental branches of medicine, Instituto de Investigación Médica para Promoción de la Medicina Científica, has been organized with private funds in Córdoba. Dr. Orias, director of the Institute, was at one time traveling fellow of the Rockefeller Foundation, working at Western Reserve and Harvard Universities. On the staff are Enrique Moisset de Espanes, who was at Harvard University in the same capacity, and Inés L. C. de Allende, who visited the University of Rochester.

Dr. Orias writes: "We all had to resign our positions in the Institute of Physiology in the Medical School of the University of Córdoba on account of the situation created in the Argentine Universities by the Perón regime."

The new Institute, he said, will be devoted to research in endocrinology, pharmacology, and physiology of the circulation of the blood. The address is 25 de Mayo 1122, Córdoba.

Recent Deaths

Horace A. Shonle, 54, director of the organic chemical research division of Eli Lilly & Company, Indianapolis, and authority on barbituric compounds, died February 24 following a brief illness. Mr. Shonle discovered amytal in 1924 and was later responsible for the discovery of seconal.

A. R. Mann, 66, agricultural economist and former provost of Cornell University, died on February 21 in New York City upon his return from a special assignment in Europe for the War Department.

Lily Bell Sefton Deatrick, 63, professor of chemistry, West Virginia University, Morgantown, died November 25 in Morgantown. She is survived by her husband, Eugene P. Deatrick, also of the Department of Chemistry, West Virginia University.

Make Plans for. . .

Crystallographic Society, 2nd annual meeting, March 19–21, U. S. Naval Academy, Annapolis, Maryland.

Western Metal Congress and Exposition, fifth, March 22–27, Civic Auditoriums, Oakland, California.

American Association of Petroleum Geologists, 32nd annual meeting, March 24–27, Los Angeles, California.

Midwest Power Conference, March 31–April 2, Palmer House, Chicago.

American Association of Anatomists, annual meeting, April 3–5, Mount Royal Hotel, Montreal, Canada.

Institute of Mathematical Statistics, meeting on stochastic processes and noise, April 24–25, New York City.

COMMENTS
by Readers

Elementary zoology books and descriptive handbooks, some of comparatively recent date, retain the use of semantically poor thermal terminology. Similarly, inadequate or even misleading statements are used to describe the body temperature of reptiles. It is commonly stated, for example, that "reptiles have the temperature of the surrounding air." This is only vaguely true. It would seem desirable to eliminate both the semantic difficulty and the misleading statements in new and revised editions of the books.

Birds and mammals are usually referred to as warm-blooded organisms, partly because they are capable of maintaining temperatures that are ordinarily higher than that of the circumambient air, and partly because of the assumption that bird and mammal temperatures are higher than those of the so-called cold-blooded animals. Because temperatures of the air or the substratum on occasion may be higher than the body temperatures of the "warm bloods," the term loses some of its force. However, it is particularly misleading when the usage implies that modern reptiles habitually operate at lower body temperatures than the mammals. Most diurnal lizards function within an optimal range of 36–42°C. (R. B. Cowles. *Amer. Nat.*, 1940, **75,** 542–561; R. B. Cowles and C. M. Bogert. *Bull. Amer. Mus. nat. Hist.*, 1944, **83,** 265–296), which is fully as high as that of many mammals and more than equals the temperature of the more primitive birds. By this criterion, some birds, and probably no mammals, are entitled to the term warm blooded.

Wherever the terms warm blooded or cold blooded are replaced by the descriptive terms homoiotherm and poikilotherm, the concepts evoked are more nearly accurate, but it is still misleading because many lower vertebrates living in caves, all tropical fishes, and completely aquatic amphibia and reptiles are all probably more nearly homoiothermic than are many birds and mammals. In both groups of homoiotherms there are forms in which seasonal or diurnal fluctuations are characteristic physiological traits. In fact, all birds exhibit considerable rhythmic diurnal fluctuations, and many hibernating mammals as well as monotremes, marsupials, and at least some edentates are characterized by one or another type of temperature variation.

Although the nature of organisms defies our attempts to place them in unvarying categories, the most significant thermal difference between the poikilotherms and homoiotherms is the major reliance of the so-called warm-blooded animals on endogenous, internally generated sources of heat. It is for this reason that these animals were originally given the term endotherm. Conversely, since the cold-blooded animals derive practically all of their effective heating from outside the body, where it is absorbed either directly from the sun (heliothermic types) or indirectly through contact with adjacent substances (thigmothermic types), collectively they were designated as ectotherms. It is believed that the use of these terms evokes a more accurate concept of the real differences underlying the thermal physiology than do the words in current use.

Possibly as a result of the semantic inadequacy of the older terms, it is customary to state that the cold bloods—that is, the poikilotherms—live at the temperature of their environment. In a broad sense this is true, but it is misleading. The body temperature of the ectotherm is derived from its environment, which in diurnal species consists of the sunlight, the substratum, and to a less extent the circumambient air. Furthermore, if the animal is moving, the environment will differ from moment to moment. The extent to which a broad statement can be meaningless is illustrated by the following extreme example. A small lizard, *Uta stansburiana hesperis,* was captured on a windy day while it was basking in a rock crevice exposed to full sunlight. The air temperature was 13°C., but the cloacal temperature was 38°C. In this case the temperature of the lizard was the product of the environment, which consisted of the heat absorbed from the sun, heat loss to the rock on which it was perching, and to a lesser extent loss to the air. A closer analysis undoubtedly would have revealed that the air film on the lizard's body was somewhat less than 38°C., and that the air 1 mm. away would have been cooler, while that at a foot or two away would be nearer 13°C., the temperature of the uninterrupted stream of air. (R. B. Cowles, *University of California, Los Angeles,* and C. M. Bogert, *American Museum of Natural History, New York.*)

The issue of *Science* for August 2, 1946, appropriately printed a letter by Edward J. Van Liere, pleading the cause of new physiological terminology, and suggesting a distinction between asphyxiate and anoxiate. I have for some time considered the possibility of two coined words that should be of use to medical entomologists:

Transstadial. Terminology of the relationship of insects and their allies to harbored disease organisms has in the past been encumbered with such awkward terms as "stage-to-stage transmission," "generation-to-generation transmission," or the inappropriate "hereditary transmission" of disease agents in their arthropod hosts. Lately the descriptive phrase "transovarial transmission" has come into increasing favor in reference to passage of the agents from one generation to the next. As a corollary, the term "transstadial transmission" should also be concise and useful as denoting persistence or passage of such agents through the various stages of a given generation of the host. "Interstadial" would be more euphonious but less exact in combination with "transmission."

Nosarthrology. The recent war has emphasized the important field of medical entomology having to do strictly with arthropods as vectors of disease agents. The recently evolved word "virology" is a somewhat parallel case in the broader field of bacteriology. "Nosarthrology" is suggested as an appropriate term for the science of transmission of disease agents by insects and their allies which could be used in a more restricted sense than the broader current conception of medical entomology. (Col. Cornelius B. Philip, *U. S. Public Health Service, Hamilton, Montana.*)

TECHNICAL PAPERS

Effects of 2,4-D on Seed Germination and Respiration

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Synthetic plant-growth-promoting substances, known also as auxins, have been found to possess many practical applications in agriculture. They have been extensively used to prevent premature shedding of fruits, to induce rooting of cuttings, to induce parthenocarpy and ensure fruiting, to keep the bud in dormancy, and to improve the well-being of a plant in general (*4*). The reasons for the versatility of auxin treatment are still being conjectured. Only at very high dilutions (1 ppm) does indole acetic acid promote growth and accelerate protoplasmic streaming in the *Avena* coleoptile; at slightly higher concentrations (10–100 ppm) it depresses growth, stunts the plant, but induces root formation; and at still higher (100–1,000 ppm) it becomes destructive to chlorophyll and to the plant as a whole (*1*). The recent successful introduction of di- or trichlorophenoxyacetic acid, a compound which possesses high auxin activities, as a translocated herbicidal spray by F. D. Jones and others has amply revealed the importance of this new phase of research on auxin treatment. Furthermore, it has been shown that the herbicidal effect of this and allied chemicals on plants can be differential and selective, *i.e.* it can be applied effectively in the field to kill some major weeds while leaving the crops unharmed (*2*).

The facts that 2,4-D can be actively absorbed by, and freely translocated in, the plant before the latter is killed, and that its lethal effect on plants can be differential, seem to us most interesting and deserving of some physiological investigation.

Germination of seeds involves many of the physiological and biochemical processes exhibited in mature plants, such as the breakdown and translocation of the stored food, the formation of seedling organs, and the high respiratory and metabolic activities during germination. If a chemical compound happens to be injurious to certain plants and if it happens to be involved in inhibiting some specific metabolic activity therein, its physiological effect can be conveniently put to test by treating germinating seeds with such a chemical, the dosage of which may be easily controlled. Various kinds of seeds, differing in structure, in their principal food constituents, and in their biochemical behavior, can be employed for the test. These differences may be expected to manifest themselves through differences in their reaction toward a given chemical treatment. This procedure was employed by us to study the physiological action of 2,4-D on plants. The chemical treatment of seeds usually results in a complete inhibition of, or a substantial delay in, germination, which, on refined analysis, may reveal some specific metabolic disturbance in the seeds.

Seeds of barley and rice were first chosen as test materials. These cereal grains, which are more or less alike in structure and food content, differ physiologically in that rice excels in fermentative faculty and is alone able to germinate in the absence of oxygen (*3*). Seeds of uniform size and appearance were selected from the pure line stock kindly furnished us by the Department of Plant Pathology, Tsing Hua University, and then divided into lots of 100 seeds each. The different lots of seeds were treated with various dilutions of 2,4-D ranging from 0.0035 to 0.1 per cent. After 24 hours of treatment, each lot of seeds was thoroughly washed with water to remove the adhering chemical and put in a labeled Petri dish in which a moist filter paper had been placed. The Petri dishes were assembled in a moist chamber maintained at 25 ± 2°C. and the rate of germination of the seeds followed at suitable intervals. As long as the filter paper in the dish is kept moist, addition of excess water is avoided. In these experiments

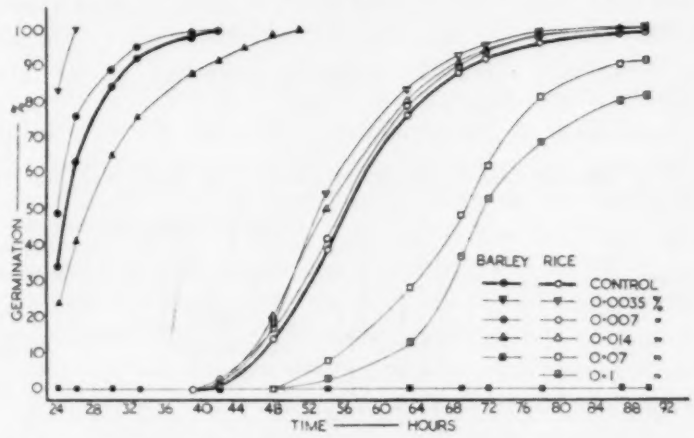

FIG. 1. The germination of barley and rice as affected by treatment with different concentrations of 2,4-D.

the criterion for germination used by Taylor (*3*) was adopted, *i.e.* seeds were regarded as germinated when any organ had attained a length of not less than 1.5 mm. The subsequent growth of the seedling was not included in our observations. The 2,4-D employed in these experiments was synthesized in our laboratory.

The rates of germination of the treated seeds are plotted in Fig. 1. Similar to other auxins, 2,4-D accelerates seed germination at low concentrations but delays it when a certain threshold of concentration is exceeded. The outstanding feature of our results is that the threshold concentration in retarding germination is higher in rice (ca. 0.07 per cent) than in barley (ca. 0.01 per cent). Furthermore, 0.07 per cent 2,4-D inhibits barley germination completely while it merely delays germination in rice. Even when the concentration is raised to 0.1 per cent, 2,4-D fails to prevent the rice from germinating, though it delays the process still further. Comparison of the germination rate of seeds treated with 2,4-D with that of seeds kept under aerobic and anaerobic conditions reveals a striking resemblance between the treated seeds and those under anaerobic condition. It seems as if oxygen were no longer available to

the treated seeds, so that the germination of barley, a typical aerobic seed, is entirely inhibited and that of rice, a seed known to be able to germinate anaerobically, is only duly delayed. Fig. 2 illustrates this point very well. The anaerobic

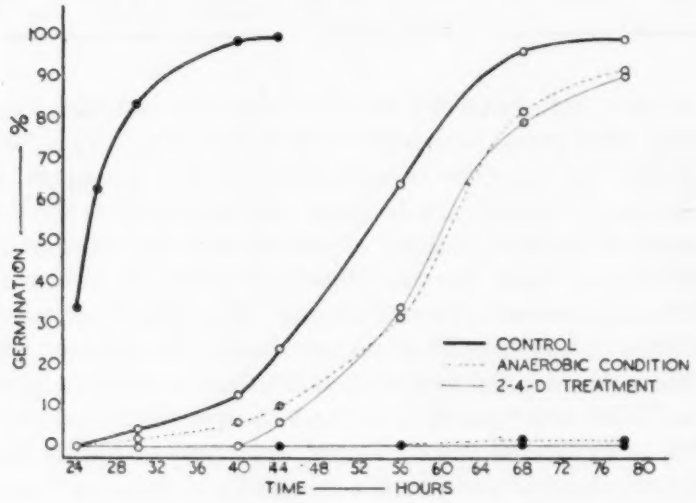
GERMINATION — % 100 90 80 70 60 50 40 30 20 10 0
24 28 32 36 40 44 48 52 56 60 64 68 72 76 80
TIME — HOURS
CONTROL
ANAEROBIC CONDITION
2-4-D TREATMENT

FIG. 2. Influence of 2,4-D treatment (0.1 per cent) and anaerobiosis on germination of barley and rice (barley = ●; rice = ○).

condition was attained by flushing the container of the germinating seeds with nitrogen.

The same procedure was extended to various other types of seeds—those which store their food in cotyledons (legumes) and those rich either in proteins (soybean) or in fats (*Raphanus*). Table 1 summarizes our findings. With the exception of sesame seeds, which may have a lower threshold of inhibition than the concentration employed, the results seem to substantiate our view regarding 2,4-D treatment.

TABLE 1

	Percentage germination under anaerobic condition	Percentage germination of seeds treated with 0.1% 2,4-D
Rice	100	100*
Barley	0	0
Wheat	0	0
Soybean	0	0
Broad bean	0	0
Peanut	0	0
Raphanus	8–10	20–30*
Sesame	15–20	0

* No subsequent growth.

For a final proof, gas exchange in the treated seeds of barley and rice was analyzed with Warburg microrespirometers. The aerobic (respiration) and anaerobic (fermentation) activities of the treated seeds during germination were calculated from the data on the assumption that the aerobic respiratory activity of the treated seeds was the same as that of the control, *i.e.* in both barley and rice, the R. Q. value is close to unity. The respiratory intensity was represented by CO_2 evolved in aerobic respiration, the value of which was obtained in the case of treated seeds by subtracting fermentation CO_2 from the total CO_2 evolved. The results are presented in Table 2. All values given are relative.

TABLE 2

RESPIRATORY ACTIVITIES OF BARLEY* AND RICE† TREATED WITH 0.1 PER CENT 2,4-D DURING EARLY PERIOD OF GERMINATION

Time (days)	Seeds	Experimentally determined: O_2 uptake, Total	O_2 uptake, Treated/Untreated	Experimentally determined: CO_2 evolution, Total	CO_2 evolution, Treated/Untreated	Calculated: Respiration CO_2 evol. (%)	Calculated: Fermentation CO_2 evol. (%)	Calculated: Fermentation CO_2 evol. / Respiration CO_2 evol.	Calculated: CO_2:O_2	Calculated: Respiratory intensity Treated/Untreated
				Barley						
1st day	Untreated	12.0	0.33	11.0	1.36	100	—	—	0.92	0.34
	2,4-D–treated	4.0		15.0		33	103	3.12	3.75	
2nd day	Untreated	17.0	0.30	16.0	0.94	100	—	—	0.94	0.29
	2,4-D–treated	5.0		15.0		29	65	2.24	3.0	
3rd day	Untreated	57.0	0.21	52.0	0.30	100	—	—	0.91	0.20
	2,4-D–treated	12.0		15.0		21	9	0.42	1.25	
				Rice						
3rd day	Untreated	8.0	0.31	7.5	1.13	100	—	—	0.94	0.28
	2,4-D–treated	2.5		8.5		31	82	2.65	3.40	
6th day	Untreated	19.5	0.51	18.5	0.81	100	—	—	0.94	0.53
	2,4-D–treated	10.0		15.0		48	33	0.70	1.50	

*† Divisions on Warburg's microrespirometer scale/90 minutes/6 seeds and /60 minutes/10 seeds, respectively.

The low ratios in respiratory intensity between the treated and untreated seeds clearly indicate that the seeds treated with 2,4-D cannot very well utilize oxygen in the air during germination and must find some other recourse, such as fer-

mentation, for energy supply. Hence, during the few days following the chemical treatment, these seeds, in comparison with the control, exhibit a low oxygen uptake and a high carbon dioxide evolution, and, consequently, a high CO_2:O_2 ratio. This effect is very similar to that caused by germinating seeds under low oxygen tension, which has been fully described by Taylor (*3*). As a result of O_2 deficiency in the medium, aerobic respiration is reduced, and this reduction is to some extent compensated for by the fermentative activity of the germinating seeds, as evidenced by the high CO_2:O_2 ratios under such a condition. If they cannot furnish the energy necessary for germination fermentatively, most seeds will fail to germinate at all. If, as in rice, the seed is especially gifted with a highly functional fermentative mechanism, it can proceed to germinate, although with some delay, even after 2,4-D treatment or under anaerobic condition. However, this condition cannot go on indefinitely. Even rice cannot continue to grow in the complete absence of oxygen.

During recent years evidence has accumulated which shows that auxin is involved in the 4-carbon acid respiratory system (*4*). The increased respiration due to auxin treatment was found to parallel the increase in elongation of, and the acceleration of protoplasmic streaming in, the *Avena* coleoptile. This statement is probably true only at certain low concentrations of auxin.

Our experiments have shown that 2,4-D, at low concentrations (0.01 per cent), promotes germination; but, at higher concentrations (0.1 per cent), it begins to inhibit aerobic respiration and checks germination.

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Prevention of Respiratory Embarrassment in Therapeutic Curarized Convulsions

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Transitory asphyxia and cyanosis occur so frequently in spontaneous and therapeutically induced convulsions that cerebral anoxia was cons dered a possible explanation for the beneficial effects of convulsions in mental disorders. However, it has been demonstrated that the production of cerebral anoxia by the inhalation of nitrogen has no such therapeutic value (*4*). On the contrary, asphyxia contributes clinically to cardiac strain and plays a role in the fatalities and near-fatalities that occasionally occur in convulsions. The treatment of asphyxia by the use of chemical stimulants has proved futile (*3*). Administration of oxygen is ineffectual unless the air passages are open. The presence of trismus makes the installation of apparatus to clear the respiratory passages *after* a convulsion difficult (*1*) and often impossible. We have found that although administration of the convulsant electric current during inspiration facilitates postconvulsive breathing, since the first respiratory movement is then an expiration which clears the passages, this so increases intrapulmonary and venous pressure as to make the procedure not without risk. This procedure has, therefore, been discarded.

Certain few patients are "hard breathers" in that they persistently have asphyxial episodes during and after convulsive seizures. They seem to fall into two main categories: (1) those whose illness is characterized by agitation, depression, rejection of food and sleep, and other psychological "oral" qualities; and (2) patients with evidence of generalized arteriosclerosis or other neurologic complications, in whom there appears to be some inefficiency in the respiratory apparatus. The physician is sometimes compelled to treat a patient with coronary disease, whose agitation is so marked and dangerous to the heart as to necessitate the administration of shock treatment in an attempt to terminate the mental disorder. It is precisely those patients falling into both categories who are apt to show respiratory difficulties and in whom asphyxia is most dangerous. In these patients it is impossible to soften the convulsion adequately by means of curare because it increases respiratory difficulty and asphyxia. By premedication with sodium pentothal or sodium amytal (*2*) one can increase slightly the dosage of curare. The sedation seems to diminish the preconvulsive anxiety and restlessness and to diminish pharyngeal spasm. Unfortunately, these barbiturates increase the postconvulsive apnea.

We have found a simple means of avoiding asphyxia and consequently diminishing cardiac strain. With this technique a Guedel rubber airway is installed *during* the convulsion.

The patient is prepared as usual for the treatment. He is placed supine on a flat bed without hyperextension, since the latter increases respiratory difficulty. The barbiturate and curare, or curare alone, are injected. In electroshock convulsions, a cloth gag is placed between the teeth to protect the tongue and lips. The current is then applied. During the initial tonic flexion phase, the gag is forcibly bitten. This is followed by a moment of relaxation in which the mouth is opened widely. At this point a Guedel rubber airway is introduced to the hilt. Where metrazol is used, the cloth gag is not necessary. The initial movement of the mouth is an opening one, and the airway is similarly introduced. With the airway in place there may be respiratory exchange in the m dst of the convulsion. Before the end of the convulsion, the patient is turned on the side with the mouth down. Mucus and saliva will flow from the airway. Respiration usually begins shortly after the convulsion is over. The airway is removed a few minutes after the convulsion, when respirations are normal and the mouth and jaw relaxed.

With this technique asphyxia and cyanosis are now rare. There are occasional periods of apnea, which seem to be of central origin. In these apneic periods it is a simple matter, with the air passages open, to institute respiration, if one so desires, by abdominal pressure. The airway acts as an efficient mouth gag and bitten tongues and lips are infrequent. A theoretical objection to the method is the possibility of dislocation of the jaw and trauma to the pharynx, but in practice neither occurs. Postconvulsive headache, nausea, and confusion have been diminished considerably. Larger amounts of curare can be administered safely to hard breathers. In one patient with known severe coronary disease, the postconvulsive electrocardiographic changes were less marked and of much

shorter duration with this method. Patients who are not sedated are less apt to show postconvulsive restlessness. The postconvulsive hypertension is reduced, but not entirely eliminated. Observations with different methods of therapy indicate that there are at least four factors in postconvulsive hypertension: (1) anxiety and restlessness, which can be alleviated by means of intravenous sodium pentothal or sodium amytal; (2) muscular exertion, which can be alleviated by means of curare; (3) asphyxia, which can be prevented by the method described; and (4) a cardiac convulsant action. The heart seems to take part in the generalized convulsion, cardiac irregularities having been reported during seizures. These are less marked when asphyxia is prevented. Hypertension does not always accompany partial convulsions, but is an invariable component of generalized seizures, although it is less marked and of shorter duration with the technique described. In the postconvulsive period, especially with metrazol, premature cardiac beats coincide with mild, generalized twitches. These coincide too well temporally to be explained except on the basis of a common stimulus. The fact that this hypertension can be temporarily arrested by carotid sinus pressure suggests that there is a nervous pathway through the autonomic nervous system. Clinically, however, with the prevention of asphyxia, anxiety, restlessness, and severe muscular exertion by means of the technique outlined (barbiturate, curare, intraconvulsive airway) most cardiac patients seem able to stand the convulsion with minimal evidence of cardiac strain.

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Photoinactivation of Milk Fat Lipase and the Origin of Bitter Flavor in Milk

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H. D. Kay recently reported in a letter to the editor of ***Nature*** (*2*) that an enzyme which hydrolyzes tributyrin in milk (tributyrinase) is sensitive to light and that the atmospheric oxygen plays an important part in the photodestruction of the enzyme. This letter prompts the present writer to release information pertaining to the mechanism of the photochemical inactivation of milk fat lipase and to the origin of bitter flavor in milk, obtained in connection with studies of the interrelationship of ascorbic acid oxidation in milk and the reaction which produces the tallowy flavor (*4*). It has been found that the activity of milk fat lipase, as produced by cooling, warming, and the subsequent holding of milk at 0–5° C. from 24 to 48 hours (*5*), varied with the ascorbic acid content of the milk reduced to various levels by exposure to light (Fig. 1B). The phenomenon suggested the possibility that H_2O_2, formed in the course of the photooxidation of ascorbic acid (*1*), might be responsible for the inactivation of milk fat lipase.

This postulation made it necessary to determine the effect of H_2O_2, added to milk in different quantities but not in excess of that required to oxidize the ascorbic acid completely, upon the activity of milk fat lipase. The results were that both processes, namely, the oxidation of ascorbic acid and the destruction of lipase, were promoted simultaneously in the milk (Fig. 1A).

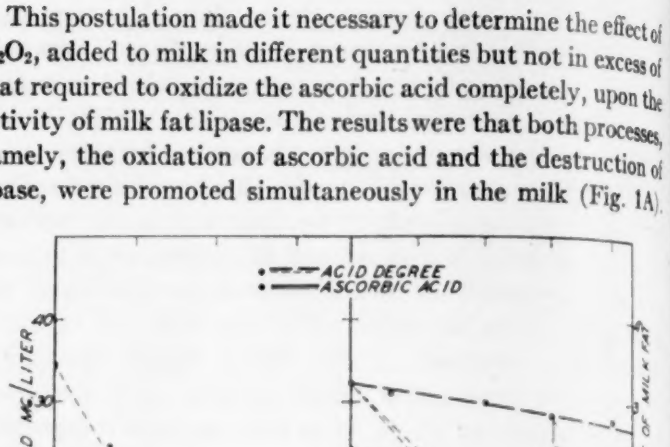

Fig. 1. Simultaneous promotion of ascorbic acid oxidation and of inactivation of milk fat enzyme lipase in the milk either in the presence of added H_2O_2 or photochemically by the exposure of milk in Erlenmeyer flasks to direct sunlight (B, 1) or northern daylight (B, 2). Sample 1 C was exposed in the presence of added catalase. Lipolysis was activated by cooling-warming-recooling of milk, and activity measured by increase in the acid degrees of fat at the end of a 48-hour holding period at 0–5°C. Ascorbic acid content of the milk was followed by direct titration with 2,6-dichlorophenol-indophenol in acid solution.

Consequently, to prove that the photooxidation of milk fat lipase resulted from H_2O_2 formed in the course of ascorbic acid oxidation, a portion of lipolytically active milk was fortified with catalase prior to exposure to sunlight. The amount of catalase (*6*) added to milk was sufficient to prevent ascorbic acid oxidation in the presence of 0.028–0.03 ml. of 30 per cent H_2O_2 solution/l. of milk, added subsequently. The activity of catalase, determined again at the end of 40 minutes of exposure to sunlight by the addition of ascorbic acid to milk depleted of its content and of H_2O_2, was found to be the same as at the starting point. The photoinactivation of milk fat lipase was not prevented, however, by the addition of catalase to milk (Fig. 1B). In fact, the enzyme was inactivated at a slightly faster rate in the presence of catalase as compared with that in the control milk. It was apparent, therefore, that the photoinactivation of lipase is an independent reaction, and that H_2O_2 formed in the course of ascorbic acid oxidation might play an auxiliary part. This evidence was supported further by data concerning the effect of the depletion of the ascorbic acid content of milk, prior to exposure to light, by cucumber juice oxidase. Since the ascorbic acid–cucumber juice oxidase system uses one atom of oxygen per molecule of vitamin C (*1*), it was safe to assume that no H_2O_2 was present in the milk at the time of exposure. Again, the sensitivity to light of the milk-fat-splitting enzyme was found to be approximately the same as in the control portion of milk containing ascorbic acid. It was also found that sensitivity of milk lipase to light varied appreciably between the samples of milk from different cows and that, of the 20 samples studied, only two samples showed from 80 to 90 per cent loss in the lipolytic activity due to 30 minutes' exposure to light. The losses of lipase in the remaining samples of milk varied from 50 to 80 per cent. The inactivation of milk

lipase by added H_2O_2 was considerably reduced in the presence of catalase, whereas deoxygenated milk sealed under vacuum showed an increase in lipolytic activity over that in control milk. The continuous exposure to sunlight up to 90 minutes reduced its activity approximately 10 per cent. Fat lipolysis in milk is quite often accompanied by the development of bitter flavor, which can be traced primarily to the gravity cream layer of the milk. This could be demonstrated by draining off carefully the gravity skim milk below the cream layer of milk at the end of a 24-hour holding period at 0–5° C., in which lipolysis was stimulated by cooling and warming prior to storage. It indicated that the changes in the chemical properties both of the fat and of the fat-globules-stabilizing membrane could be responsible for the development of the bitter flavor. Not only has the milk-fat-agglutinin concentrate (gravity cream plasma, obtained by the reseparation of gravity cream forewarmed to 37–40° C. in the cream separator, *3*) a tendency to develop bitter flavor on standing at refrigeration temperatures, but the milk fat from very rancid milk is quite often bitter. The compound responsible for the bitter flavor in the fat could be readily extracted by the re-emulsification of the fat in the skim milk.

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The Origin and Evolution of Meiosis[1]

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The question of the relation of mitosis to meiosis has received as much attention, perhaps, as any in biology. The discussion has been focused, for the most part, on the mechanism responsible for the change from one type of nuclear division to the other, and the manner in which meiosis, which made sex and biparental inheritance possible, originated. Certainly, one difficulty in tracing the origin and development of meiosis from mitosis has been the failure to understand clearly the small but fundamental differences in the two processes. And, of course, the assumption by some biologists that the two processes were almost unrelated has not helped toward an understanding of them. Far too little attention has been given to the role of the centriole and the relation, in time, of its duplication to that of the chromosomes, for herein lies the key to an understanding of the manner in which a cell changes from one process to the other.

For many years I have been studying the chromosomes of 40 genera and more than 500 species of hypermastigote and polymastigote flagellates from termites and the wood-feeding roach, *Cryptocercus punctulatus* (*1*). The protozoa of *Cryptocercus* are profoundly influenced by the molting of their host (*2*). Between molts they have the haploid number of chromosomes, and division is mitotic; during molting their chromosome number is doubled, and zygotic meiosis, which follows, returns them to haploids, where they remain until their host molts again. In three genera, *Trichonympha*, *Leptospironympha*, and *Eucomonympha*, the change from haploidy to diploidy is brought about by fertilization; in others, particularly *Saccinobaculus*, it results from the autogamy. In these genera sexual processes similar to those of higher animals and plants have become fairly well established, but not permanently, for sometimes they revert to a more primitive process, such as the one that has become very well established in *Barbulanympha* and several other genera, which process will be described presently.

Of the total number of genera studied there are six which, in my opinion, are particularly important, since they serve to show the manner in which meiosis has arisen from mitosis. Among these, two processes, permanent mitotic diploidy and meiosis without gametogenesis, deserve consideration. They lie between fertilization (including autogamy) on the one hand, and mitosis on the other.

In the first process, which is seen in the genera *Holomastigotoides* and *Spirotrichosoma*, the chromosomes, in certain instances, have become permanently diploid, since these genera have not been able to develop a method for changing back to haploids. In the genus *Holomastigotoides*, which is present in many genera of termites distributed through most of the tropical and semitropical regions of the earth, the haploid number of chromosomes is 2, and most of the species have this number. However, in each of the species of termites that I have examined from the genera *Prorhinotermes*, *Psammotermes*, *Coptotermes*, and *Heterotermes*, diploids have also been present, together with a 3-chromosome form (1n, 2n); and, in *Psammotermes*, there is in addition a 5-chromosome form (2n, 3n). All of these are derived from the basic 2-chromosome form. This polyploidy is not one of recent origin, since, for example, precisely the same forms occur in widely separated species of *Prorhinotermes* (southern Florida, Java, Madagascar), which termites have been separated at least since the beginning of the Tertiary, and probably much longer. *Holomastigotoides*, then, in a few instances, has been able to survive in a permanent diploid condition.

Another example of a similar situation is found in the genus *Spirotrichosoma*, present in three species of *Stolotermes* (a very primitive termite) from Australia, one from South Africa, and one from New Zealand. The haploid number of chromosomes is 12—the number present in all the species of *Spirotrichosoma* from the Australian and South African species of *Stolotermes*. This same number also occurs in the *Spirotrichosoma* from the New Zealand species of *Stolotermes*, but polyploids with 24, 48, and 60 chromosomes are also present. Thus, with a larger number of chromosomes, the difficulty an organism encounters in permanently adapting itself to polyploidy seems to be greatly increased.

Nuclear division of these polyploids can be seen very plainly, especially those with 4 rod-shaped chromosomes. Every division is exactly alike: synapsis in the prophase, followed by formation of tetrads, and movement of the chromosomes to the poles as dyads, *i.e.* every division is exactly like the first division in meiosis. One may ask: Why isn't this followed by a second meiotic division, thus returning the chromosomes to the haploid condition? The answer is simple: the centrioles are

[1] Aided by a grant from the Milton Fund.

not duplicated until the chromosomes have also been duplicated, and therefore reduction in chromosome number is impossible. Then, so long as the chromosomes are duplicated every time the centrioles are, diploidy is permanent. The schedule of centriole-chromosome duplication must be changed before reduction can occur.

In the second process, which is termed endomitosis, meiosis occurs, but it is neither preceded nor followed by nuclear fusion. Several genera are involved, not all of which behave in the same manner, but nearly enough so, perhaps, that only one, *Barbulanympha*, need be mentioned. This is an unusually large cell with two interphase centrioles 40–50 μ long and 3–4 μ in width, with centrosomes 5–6 μ in diameter surrounding their distal ends. It is from these ends of the centrioles that the achromatic figure is produced, while the other, or proximal, ends produce new centrioles directly and other extranuclear organelles (flagella, axostyles, and parabasals) indirectly. As a result of molting, these centrioles degenerate and, because of their size, the process may be observed step by step; but before they degenerate each produces a small, new one from its proximal end, just as in each mitotic division. Shortly after the old, or parent, centrioles degenerate, parabasals, axostyles, and flagella begin to do so, the last to disappear being the flagella. Before degeneration of these organelles has progressed very far, two small, new, intracytoplasmic, flagellated areas, produced by the new centrioles, make their appearance adjacent to the nucleus, which at this time lies more or less in the center of the cell, having migrated there together with the new centrioles. There is one new, short centriole underneath each area, and as these become longer and larger, so do the flagellated areas, until finally both are fully grown. Shortly before growth of the flagellated areas is completed, new sets of parabasals and axostyles begin to grow out from their inner margins. Thus, two complete sets of extranuclear organelles arise from the new centrioles and replace the two degenerated sets. The flagella, which are motile throughout their growth period, remain in the cytoplasm until a few hours after the roach sheds its exoskeleton and then are extroverted.

About the time the new flagellated areas begin to develop there is a duplication of the chromosomes, but, since the short, new centrioles, the only ones now present, cannot produce an achromatic figure to move the chromosomes to separate poles, they remain in a single, undivided nucleus, in which they go through all the phases of mitosis. About two days after the new centrioles attain full size, they begin to produce an achromatic figure from their distal ends and, shortly before this takes place, the chromosomes are duplicated again, so that now each chromosome is represented four times. As prophase shortening occurs, synapsis begins, and soon the plainest tetrads I have ever seen are formed. This is followed by the first meiotic division, the chromosomes going to the poles as dyads. Then the centrioles are duplicated quickly and produce an achromatic figure which functions in the second meiotic division, before duplication of the chromosomes can occur, the chromosomes, of course, going to the poles singly.

Ordinarily, in mitosis in *Barbulanympha* it is late telophase, frequently after cytoplasmic division, before the new centriole begins to elongate by the side of the old or persisting one; but by the first meiotic metaphase growth has already begun, and by late anaphase or early telophase it is almost complete. It is very easy, then, to see in *Barbulanympha*, where the centrioles are so large, that the mechanism which makes the reduction in chromosome number possible is the speeded-up duplication and function of the centrioles without duplication of the chromosomes. In other words, the centrioles are duplicated between the first and second meiotic divisions while the chromosomes are not, and in this manner the centrioles make up for the

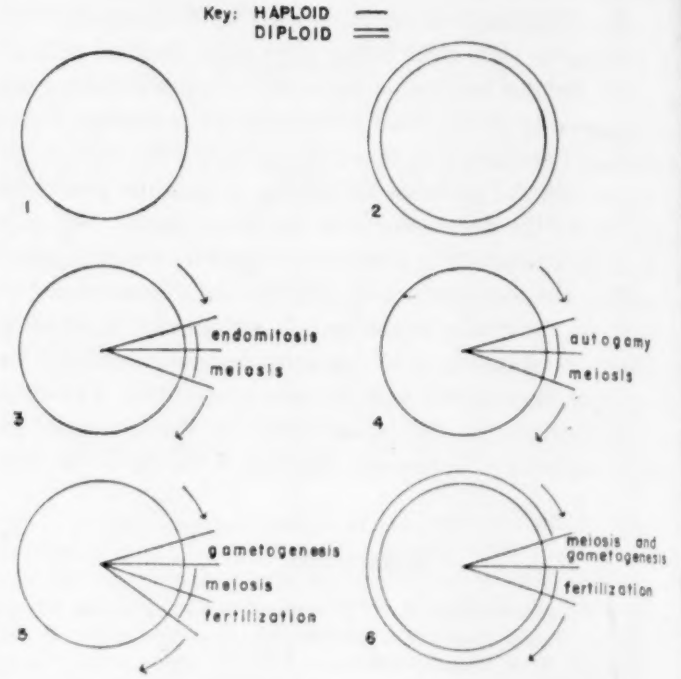

FIG. 1. Progressive stages in the origin and evolution of meiosis. (Each circle represents a life cycle.)

generation which was lost earlier (due to degeneration). In the first meiotic division the centrioles are somewhat ahead of the chromosomes and produce an achromatic figure which is ready to function before the relational coiling of the chromatids has time to come out, and poleward movement as dyads results.

It should be noted that *Barbulanympha* usually behaves in the manner just described, but sometimes the old centrioles produce an achromatic figure before they degenerate. When this happens, nuclear division occurs. The daughter nuclei fuse, and, so far as chromosomes are concerned, the end result is the same as if the nucleus had not divided. This process, termed autogamy, is the usual one in *Urinympha*, although chromosomal duplication without nuclear division also occurs. In these, and other genera too, the type of behavior depends on when a generation of centrioles is lost: if early, duplication of chromosomes without nuclear division results; if late, nuclear division occurs.

The endomitosis of *Barbulanympha* and other genera is closely related to that in several types of cells in insects, reaching its highest development in the multiple, giant chromosomes of the salivary glands of the Diptera. However, insects have developed no workable method of relieving the polyploidy and, because of the instability imposed by such a condition, these cells degenerate, while in *Barbulanympha* polyploidy is always relieved by meiosis, and no degeneration results. Since endomitosis in these protozoa is brought on by the molting fluid of their insect host, similar secretions may be responsible for the production of endomitosis in the tissues of the insects themselves, resulting eventually in degeneration followed by reorganization (metamorphosis).

In gametic meiosis, which precedes fertilization, and in zygotic meiosis, which follows fertilization, centrioles are dup-

licated without a corresponding duplication of the chromosomes, and this extra generation makes up for the one lost at fertilization by one of the gametes (each gamete has two centrioles). Briefly, then, in changing from mitosis to meiosis, the centrioles gain a generation on the chromosomes, and in changing back to mitosis, they lose a generation, although ultimately there are the same number of generations of both.

We see in *Barbulanympha* and *Holomastigotoides* the changes which occurred in the transition from mitosis to meiosis, resulting finally in the formation of gametes. The first step is diploidy, and anything which prevents the centrioles from producing an achromatic figure or the achromatic figure from functioning properly in the movement of chromosomes can bring about a change from haploidy to diploidy. This is as far as *Holomastigotoides* and *Spirotrichosoma* have been able to go. *Barbulanympha* has gone one step beyond these organisms; by throwing the centriole-chromosome duplication schedule out of line, it has evolved a method for changing from haploidy to diploidy and vice versa. The next step is seen in *Saccinobaculus* and *Urinympha*, and sometimes in *Barbulanympha*, where the loss of a generation of centrioles does not usually occur until after the nucleus divides (otherwise the nucleus would not divide). Cytoplasmic division does not occur, the nuclei fuse, the chromosomes are duplicated, and two meiotic divisions change them to haploids. The next and final step occurs in *Trichonympha* and two other genera. The advance is a small but very important one: the cytoplasm divides and thus produces gametes which are free to fuse in any manner.

Evolution of meiosis has been direct: *Holomastigotoides*, haploidy to diploidy; *Barbulanympha*, diploidy to haploidy and vice versa; *Saccinobaculus*, fusion of nuclei; *Trichonympha*, cytoplasmic division producing gametes. In each stage after the first one, the events of the preceding stage are repeated, and one additional step forward is taken. *Trichonympha*, for example, goes through all the stages that the other organisms do and, in addition, produces gametes.

If meiosis, as many observations indicate, serves to relieve the instability of polyploidy—the relief when it is zygotic usually being for a longer period than when it is gametic—one might almost say that biparental inheritance and all the evolution that it has produced resulted because of the particular method which most organisms developed to free themselves from the limitations of permanent polyploidy.

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Are Lake Salmon Hereditarily Distinct?

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Peculiar salmon found in certain lakes of Europe and eastern North America have been considered by taxonomists to be distinct species (e.g. *Salmo sebago*, *1*), merely subspecies (e.g. *Salmo salar sebago* and *S. s. ouananiche*, *3*), or varieties (e.g. *S. s.* var. *lacustris*, *2*) of the ordinary sea salmon.

Similar, supposedly nonmigratory kinds have been found in various other species of *Salmonidae*. Without proof, there should not be unquestioning acceptance of these as being hereditarily distinct kinds rather than the effects of environment on the individuals. The utter lack of published data from experiments to distinguish the effects of heredity and environment and the difficulty of carrying out such experiments should make the following of interest.

At Grand (Shubenacadie) Lake, Nova Scotia, the young from the lake salmon, locally known as "grayling," are reared for planting to get "grayling," and the young of sea-running salmon from the River Philip of northern Nova Scotia are reared for planting to get sea salmon. Grand Lake discharges into Shubenacadie River, which contains sea-running salmon. These evidently spawn in tributaries (entering the river below Grand Lake) which drain a relatively lakeless and arable country in comparison with the rocky country, well provided with lakes, that forms the watershed of Grand Lake. There is no physical barrier to prevent the young of these "grayling" from descending to the sea or the sea salmon from ascending into the lakes, which they may do. Are the differences in appearance, structure, and migration between "grayling" and sea salmon the results of a difference in heredity, which would justify keeping the stocks separate, or are they the results of differences in the conditions they face as they grow up?

In June of both 1944 and 1945, yearling offspring of lake and sea salmon, as reared at Grand Lake, were marked distinctively and planted together in equal numbers in streams in a linear series draining into Grand Lake. This has been a cooperative experiment by the Fisheries Research Board of Canada and the Fish Culture Branch of the Department of Fisheries. Supt. W. H. Cameron reared the salmon and marked them, the "lake" salmon by removal of the adipose and right pelvic, and the "sea" salmon by removal of the adipose and left pelvic fins. The streams planted formed, with intervening lakes all tenanted by lake salmon, an ascending linear series: Grand Lake, lower Rawdon River (½ mile long), Long (Kinsac) Lake, upper Rawdon River (½ mile long), Beaverbank Lake, and Beaver River (1-mile stretch).

Very few survivors were found in September seinings, either from the 9,538 marked yearlings planted in 1944 or from the 9,240 planted in 1945. Although the streams had scarcely any bottom suitable for spawning, native parr of comparable size (yearlings or older) were present and finally predominated over the marked fish, as if they kept possession of the good places in the streams by virtue of being there first. So far as could be judged by September seining, the few parr were in both years mainly in the lower part of Beaver River, but the numbers taken were very small: 1944—9 native, 1 "sea," 1 "lake"; 1945—16 native, 1 "sea," 1 "lake." With higher water they were more numerous in 1945 than in 1944 (more taken with less seining), which afforded a better opportunity to follow their movements.

That they may have descended into the lakes shortly after planting and survived there seems negatived by the facts that (1) five lots of 50 yearlings each when planted in 1945 above traps in branches of the Petitcodiac River, N.B., failed during that season to appear in the traps or to be seined more than 200 yards from the point of planting, and (2) 175 yearlings planted in 1946 above a trap on the lower Rawdon River failed to appear in the trap and yet disappeared utterly so far as seining showed.

With so few survivors even in the first few months of stream

life, the only good chance for determining any difference in migratory behavior seemed to be to trap the fish when descending as smolts the next spring. Only one trap was feasible, and this was placed on the lower Rawdon River near the lower limit of planting. If neither kind migrates seaward through Grand Lake, a trap at its outlet will get no smolts—a fact which might be interpreted as failure of any "sea" salmon to survive. If "lake" smolts, in descending, stop in the first lake they reach, but "sea" smolts continue seaward, a trap in the lower Rawdon will take "lake" smolts only from lower Rawdon but upper Rawdon and Beaver as well as lower Rawdon "sea" smolts. With such a difference in migratory behavior, it was expected that more "sea" than "lake" smolts would be trapped.

D. I. Rice, of Dalhousie University, Halifax, constructed the trap and operated it from May 26 to July 31, 1946. No salmon descended after June 12 by which time 105 native, 2 "lake," and 2 "sea" smolts had entered the trap. There was, therefore, failure to find any difference in migratory behavior. Further experiments are desirable to discover possible hereditary differences in migratory behavior of supposed "races" or "strains" in salmonid species.

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Role of Glucose in Promoting Growth of *Lactobacilli* in Saliva

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It has been shown that an oral strain of *Lactobacillus* grows and produces acid to a maximal extent when incubated on a synthetic medium consisting of d-glucose, tryptophane, sodium acetate, potassium phosphates, thiamine hydrochloride, calcium pantothenate, nicotinic acid, and casein hydrolyzate (vitamin free) (*4*). In a subsequent report (*2*) it was shown that whole saliva could substitute only partially for the three water-soluble vitamins, but completely substituted for the mineral salt fraction of the synthetic media. However, the whole saliva did not serve as a substitute for either casein hydrolyzate or tryptophane. In a later paper (*3*) saliva hydrolyzed by acid or alkali was found capable of substituting for casein hydrolyzate in the synthetic media. It was also found that it was unnecessary to add l-tryptophane to the media when an alkali hydrolyzate of saliva was substituted. These observations suggested saliva as a potential source of the amino acids found essential for the growth of an oral strain of *Lactobacillus*.

The present report is concerned with (a) observations on some chemical changes occurring in saliva incubated with glucose at body temperature, and (b) the use of an incubated saliva-glucose mixture as a substitute for tryptophane and for casein hydrolyzate in a synthetic medium. For these purposes whole saliva, collected from individuals, was incubated at 37.5°C. with and without glucose. To estimate the proteolysis occurring in incubating saliva the "carboxyl CO_2"[1] changes were determined. The ammonia (plus urea) nitrogen changes were also measured as an index of deamination.

As a result of the addition of glucose to incubating saliva there was an increase of approximately 100 per cent in the "carboxyl CO_2" liberated during the incubation. Also, markedly less ammonia was formed in the saliva incubated with glucose. These results are interpreted as evidence that the presence of glucose in saliva favors proteolysis over deamination. Table 1 illustrates the findings in a typical experiment. Further observations have been made regarding the ability of saliva, given preliminary incubation in the presence of glucose, to substitute for tryptophane and to a lesser extent for the casein hydrolyzate in synthetic media. Typical findings are shown in Table 2.

TABLE 1

Changes in "Carboxyl CO_2" and in Ammonia (Plus Urea) Nitrogen of Incubating Saliva With and Without Added Glucose

Period of incubation (hrs.)	"Carboxyl CO_2" present (mg. %)	Ammonia (plus urea) nitrogen (mg. %)	pH
No glucose present			
0	1.52	20.9	8.25
120	0.42	45.9	7.47
1% glucose added			
0	1.52	20.9	8.25
120	4.07	22.6	3.68

TABLE 2

Acid Produced in Basic Medium in Which Saliva Incubated for 192 Hours Was Substituted for Certain Essential Growth Factors

Replacement	Essential substance omitted from media	Acid produced (ml.)
Saliva incubated without glucose	Casein hydrolyzate	0.06
Saliva incubated with glucose	Casein hydrolyzate	1.05
Saliva incubated without glucose	Tryptophane	0.18
Saliva incubated with glucose	Tryptophane	5.00

These chemical findings suggest an additional role for glucose in the physiology of the oral cavity. In contact with saliva at body temperature, glucose assists in the liberation of amino acids which can be utilized as nutrients for the growth of oral *Lactobacilli*. The data obtained in this investigation will be published in detail at a later date.

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[1] Terminology of Van Slyke, Dillon, MacFadyen, and Hamilton (*1*).

IN THE LABORATORY

High-Frequency Dielectric Heating in Heterogeneous Catalysis

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High-frequency dielectric heating of materials is rapidly becoming a common practice in the plastics, wood, cellulose, and other industries (*1*). There are many advantages in this method of heating materials to a desired temperature. Since the dielectric heating arises within the material, due to rotational motion of molecules or translational oscillation of ions, the material is heated uniformly from the inside, and the factors of heat transfer are not involved. High-frequency dielectric heating is characterized by (1) speed of attaining a desired temperature, (2) uniformity of heating, and (3) absence of heat transfer from without.

These features make it very attractive for application in heterogeneous catalytic reactions. The uniformity of heating

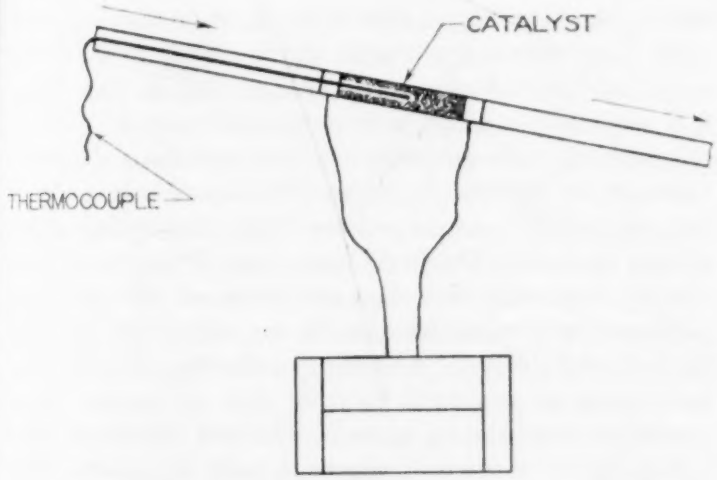

FIG. 1.

will eliminate the local overheating in spots of the catalyst and consequently minimize undesirable side reactions, increase the life of the catalyst, and produce a more uniform product. The rapidity of attaining the desired temperatures might decrease the over-all processing time, increase the space velocity, and decrease the size of the catalytic chamber.

These last features could have particular advantage for catalytic processes using a so-called "fluidizing" technique such as fluid catalytic cracking of petroleum. Naturally, only such solid catalysts as are dielectric by nature can be heated by high-frequency electric field.

In the following experiments, conducted in our laboratory, two reactions were carried out using dielectric catalysts: (1) dehydration of ethyl alcohol over alumina, and (2) dehydrocyclization of heptane to toluene over chromia-alumina.

The apparatus[1] consisted of a pyrex glass tube, with an inside diameter of 20 mm., filled with catalyst. The catalyst bed was 20 cm. long. Two brass electrodes were placed on both ends of the catalytic bed, outside the glass tube and connected to a Westinghouse radio frequency generator (1-KW unit).

After establishing a desired temperature (measured by a thermocouple placed in the center of the catalyst bed), which took from 3 to 5 minutes, the materials were introduced and the products recovered and analyzed in the usual way. The arrangement is shown in Fig. 1. The reactions proceeded with excellent results, giving a 90 per cent yield in the case of dehydration (at 350° and space velocity of 0.5) and 75 per cent yield for dehydrocyclization (at 500° and space velocity of 0.5).

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Method for Differential Staining of Mycorrhizal Roots

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In connection with an investigation of the cause of a foliar decline disease of southern pines (*2*), a study was made of the anatomical features of mycorrhizal roots formed on shortleaf pine (*Pinus echinata* Mill.). Several techniques have been used for the differential staining of hyphae of the Hymenomycetes, which form the mantle and Hartig net of ectotrophic mycorrhizae. Cotton blue in lactophenol is fairly specific for the hyphae provided counterstaining is not desired. Young (*6*) also obtained satisfactory results with cotton blue. McArdle (*3*) used the following differential methods: (1) hematoxylin with safranine, and (2) Pianeze III. In a study of the mycorrhizae of Colorado flora, Thomas (*5*) used a combination of safranine and fast green. A modification of the orseillein BB procedure described by Strasburger (*4*) has been used for staining mycorrhizae. (It should be mentioned that orseillein is not the same as orcein.) The procedure is as follows: Stain for 10 hours in a saturated solution of orseillein BB in 3 per cent acetic acid and counterstain with crystal violet in clove oil. All of the above techniques failed to contrast clearly the mantle and Hartig net with the cortical elements of the short roots.

Experimental tests demonstrated that a modification of Cartwright's (*1*) picroaniline blue procedure is superior to the above techniques for the differential staining of mycorrhizal roots. In the procedure which has been adopted for

[1] The author wishes to thank Dr. W. F. Winget for valuable help in operating the high-frequency unit.

histologic studies of all types of such roots, the roots are fixed for at least 48 hours in a solution of 1.5 ml. of acetic acid, 8.5 ml. of formaldehyde, and 90 ml. of 50 per cent ethyl alcohol. Zirkle's (7) N-butyl alcohol procedure is used for imbedding in paraffin, and Land's gum arabic-potassium dichromate procedure, for attaching ribbons to the slides. The slides are (1) stained for approximately 30 minutes with dilute safranine prepared by adding 3 ml. of a 0.5 per cent solution of aqueous safranine to 70 ml. of water in a Coplin jar, (2) rinsed in water to remove excess stain, (3) stained for 5–10 minutes in a solution prepared by adding 3 ml. of Cartwright's picroaniline blue to 70 ml. of water in a Coplin jar, (4) rinsed again in water to remove excess stain, (5) dehydrated by carrying the slides through a series of alcohol dilutions to 95 per cent alcohol, (6) cleared in Diaphane solvent, and finally (7) mounted in Diaphane.

By this procedure the blue-staining hyphae of the Hymenomycetes associated with ectotrophic mycorrhizae are clearly contrasted with the red-staining elements of the short roots. The dark-colored hyphae of the pseudomycorrhizal fungi are not stained. Differentiation of the intracellular hyphae, which grow out from the Hartig net, was obtained by using Wratten filter B (No. 58) in the microscope lamp.

The results obtained by the use of the above technique suggest the possibility that the foliar decline diseases of pine may be related to a reversal of symbiosis, which causes the mycorrhizal fungi to become parasitic on the short roots when soil conditions become unfavorable.

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A Blood Test for Estimating the Week of Pregnancy[1]

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In a recent report (*1*) it was shown that the ability of human pregnancy plasma to inactivate pitocin increased over a thousandfold from the time of conception until term, and it was suggested that such a measurement might be useful in determining the week of pregnancy. The enzyme to which we refer as pitocinase is probably a peptidase and has not yet been fully characterized. In the present investigation it is shown that the concentration of this enzyme in the blood increases in a linear fashion for the first 16 weeks after conception, and that it is only during this period that the quantitative determination is reasonably accurate. Fortunately, it is during the first half of pregnancy that such information is usually desired, for beyond that time the activity, size, and osseous development of the baby are reasonably good criteria. The present report describes in detail the methods employed and the interpretation of the results.

[1] Supported by grants from the John and Mary Markle Foundation and the James Fund.

Method

Plasma from fresh, nonhemolyzed, oxalated blood, commercial pitocin, and saline are incubated at 37° C., and samples are removed at various times for assay of the residual pitocin. The plasma concentration and incubation times vary, of course, with the approximate duration of pregnancy. These are shown in Table 1. If the approximate duration is not known, more than one determination must be made. Immediately after mixing, one-quarter of the sample is withdrawn and diluted to 12.5 ml. with 0.85 per cent saline. One drop of 2 N acetic acid is added to bring the pH to about 5.5 (with chlorophenol red as an indicator), and the tube is placed in a boiling-water bath for 5 minutes. The sample is then filtered and neutralized (using bromthymol blue) with 1 drop of 2 N sodium hydroxide. This is the "zero time 100 per cent pitocin sample" with which the others are compared. The remaining portions, exactly equal in volume to the first, are withdrawn at the indicated times and treated in an identical manner. When incubations are prolonged for more than two hours, it is essential to incubate *in vacuo* in modified Thunberg tubes containing a few drops of toluene in order to prevent loss of enzyme activity through oxidation or bacterial action. Incubations of 24 hours are likely to give lower values because of shifting temperature optima.

TABLE 1

Wks. after conception	Range of units/ml. plasma	Incubation mixture (ml.)			Incubation times*	k′
		Pitocin	Plasma	Saline		
3–4	0.06–0.1	0.5	5.0	0	0, 18, 24 hrs.*	76
5–6	0.16–0.2	"	"	9.5	0, 18, 24 hrs.*	208
7–9	0.33–0.66	"	"	0	0, 1, 3, 5 hrs.*	76
10–12	1.0 –2.3	"	"	0	0, 20, 45, 90 min.	76
13–15	3.3 –6.0	"	"	4.5	0, 15, 30, 50 min.	139
16–18	10– 18	"	"	19.5	0, 15, 30, 45 min.	346
19–21	20– 30	"	"	Dilute to 50 ml.	"	693
22–24	35– 45	"	3.33		"	1,039
25–27	50– 65	"	2.0		"	1,732
28–30	60– 85	"	1.67		"	2,079
31–38	80–110	"	1.25		"	2,772

* When time exceeds 90 minutes, incubate anaerobically with toluene.

The relative amount of pitocin in each filtrate is then estimated by a standard U. S. P. oxytocic assay, using the isolated uterus of a rat or guinea pig. While details of the bio-assay cannot be presented in this brief communication, the technics and computations are well standardized (*2*). Obviously, the accuracy of the test hinges upon the care with which the bio-assay is made.

Using a sheet of semilog paper, the percentage of pitocin remaining in each sample is plotted (on the log scale) against time (on the arithmetic scale). Starting with 0 time and 100 per cent pitocin, a straight line is best fitted through the remaining points in order to obtain the average velocity of the reaction. The time in minutes where this line crosses the 50 per cent mark is called $t_{\frac{1}{2}}$, or the time for half destruction.

The value k′ (see Table 1) divided by the $t_{\frac{1}{2}}$ then gives the number of pitocinase units/ml. of plasma.

The value k′ is derived from the formula for a first-order reaction and takes into account the plasma dilution. In the formula, $k = \frac{1}{t} \times \log_e \frac{C_o}{C_t}$, k represents the velocity, C_o the concentration of the substrate (pitocin) at 0 time, and C_t the concentration of pitocin at the time the sample is removed. When $t = t_{\frac{1}{2}}$, the fraction $\frac{C_o}{C_t}$ always equals 2, and the equation may be written: $k = \frac{0.693}{t_{\frac{1}{2}}}$. We have defined one unit of pitocinase activity as 100 × k at 37° C., since in this instance the concentration of enzyme is proportional to the velocity of the reaction. The number of units of pitocinase/ml. of plasma therefore equals $\frac{69.3}{t_{\frac{1}{2}}} \times$ the plasma dilution. The value k′ is simply the plasma dilution × 69.3.

Results

Plasma pitocinase determinations were made on 22 normal nonpregnant women, and the mean value was 0.023 units ± S.E. 0.0024, with a standard deviation of 0.011. Curiously enough, this value fluctuates in the normal menstrual cycle, becoming 0.018 during the two weeks centering about the onset of the menstrual period and 0.044 during the two weeks centering about the time of ovulation. The highest value found, 0.06 units/ml., is indicated by Line 0 in Fig. 1 and may be compared with the mean level for women, represented by Line M.

Determinations on 24 normal men gave a mean value of 0.01 ± 0.0014, S.D. = 0.007. This is significantly lower than the value for women, since the difference between the means is 4.8 times the standard error of the difference between the means. It was noted that in four men taking 5 mg. of stilbestrol daily (for carcinoma of the prostate), the mean value was 0.04, or about the level of ovulating women. The presence of jaundice likewise produces an elevated level. It is not known whether these low and fluctuating proteolytic activities are due to the same peptidase found in pregnancy or to some protease which may have some slight inactivating effect upon pitocin.

During the first 16 weeks of normal pregnancy, 37 determinations were made (Fig. 1). Eighteen of these were made on four individuals in order to establish the basic curve, and the remainder are unselected cases, excluding only those with abnormalities of pregnancy such as hydatid moles, ectopic pregnancies, and threatened or incomplete abortions—all of which are usually associated with lower values. When the pitocinase values are plotted on a logarithmic scale, they fall on a straight line with a standard deviation of ± 5 days. In each instance, conception was assumed to have occurred two weeks before the expected onset of the first missed period. During the latter half of pregnancy, the curve begins to flatten, and the scatter is greater. When pre-eclampsia supervenes, abnormal values are almost always noted (*1*).

The slope of the line illustrated may be represented by the expression 6 (log y + 1.7). Up to 16 weeks after conception, therefore, we may say that the week of pregnancy is equal to 6 × ($\log_{10}$ of the plasma pitocinase + 1.7) ± a standard deviation of 0.7 weeks.

It may be seen that values above 0.07 units/ml. of plasma, corresponding to four weeks after conception, are diagnostic of pregnancy in women who are not jaundiced. There is no known pregnancy test which may be considered accurate prior to the fourth week. Despite its economy, this method,

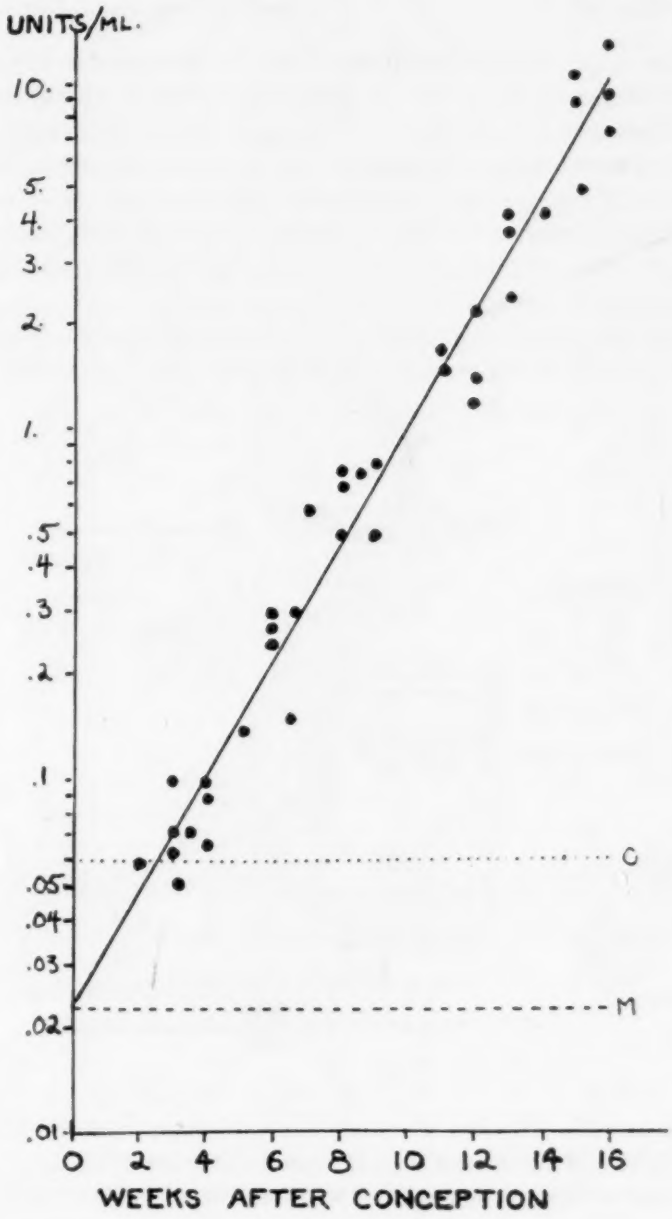

Fig. 1. Relation of plasma pitocinase concentration to the week of pregnancy. Ordinate represents the enzyme concentration in units/ml. plasma; Line M, the mean for nonpregnant women regardless of the phase of the menstrual cycle; Line O, highest level detected at the time of ovulation.

when used as a purely qualitative indication of pregnancy, requires more time and skill in its present form than a Friedman or Aschheim-Zondek test. The present data suggest that the test measures the product of placental volume and some type of specific activity, and that the latter factor is relatively constant when pregnancy is normal. The method may find usefulness, therefore, when quantitative information is desired.

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A Moist Chamber for Nerve-Muscle Experiments[1]

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The moist chamber herein described was developed in order to save the student time in performing routine laboratory experiments involving the use of the nerve-muscle preparation. The standard moist chamber in use in most laboratories is rather cumbersome and requires considerable wiring prior to starting an experiment. If two muscles are used simultaneously in the chamber or if more than one pair of electrodes are used, the actual setting up is indeed time consuming.

This moist chamber (Fig. 1) weighs only $3\frac{1}{4}$ ounces, is $1\frac{3}{8}$ inch deep, $2\frac{1}{2}$ inches wide, and $3\frac{1}{8}$ inches high. It is made of $\frac{1}{16}$-

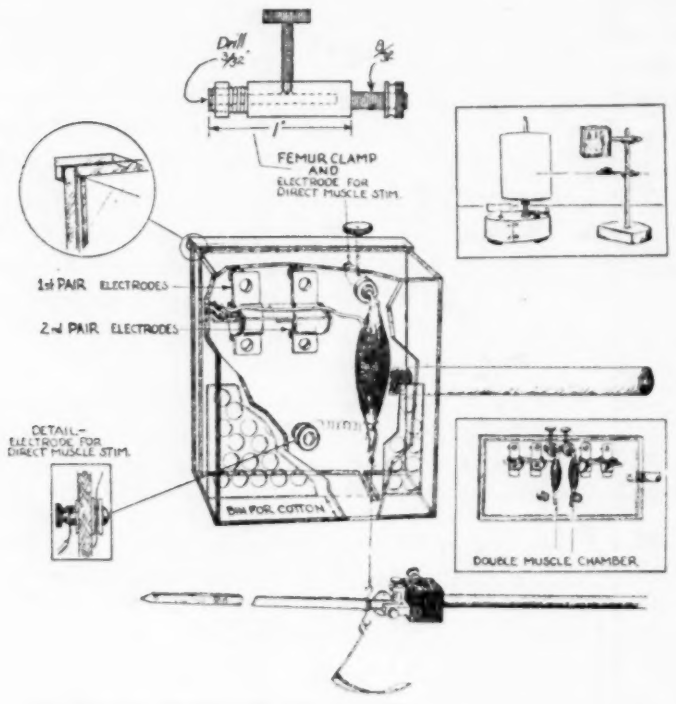

FIG. 1. Drawing of lucite moist chamber with lid partially cut away, showing a nerve-muscle preparation in place and attached to a muscle lever.

inch lucite. The femur clamps and aluminum electrodes are mounted near the top of the back panel, which is $\frac{1}{8}$ inch thick. The two pairs of electrodes are arranged 3 cm. apart, to the left and slightly below the femur clamp. Between these pairs is mounted a shelf of lucite so arranged that the nerve can be placed on it perfectly flat, thus forming a straight line for 3 cm. This group of electrodes is advantageous for experiments in which the student can determine roughly the speed of impulse conduction through the sciatic nerve.

Provision is also made for direct stimulation of the muscles. At the bottom of the back panel and near the level of the distal end of the muscle an electrode is introduced. This is an 8-32 roundheaded bolt with spaced washers and nuts around which a fine copper wire can be wrapped to conduct current to the lower part of the muscle (see detail, Fig. 1). On the back of the femur clamp is a binding post, forming a terminal for the opposite side of the electric circuit.

The cover is also of lucite and fits a flange that has been routed into the moist chamber base, forming a tight fit and thus preventing any appreciable moisture loss. The thread leading from the muscle tendon to the writing lever passes through a narrow saw cut in the lower side of the cover.

Near the front of the cover and extending for approximately two-thirds of its height is cemented a perforated plate of lucite, thus making a bin into which moist cotton can be placed. The perforations provide openings through which the moisture passes.

The electrodes, of thin sheet aluminum, are arranged so as to take up a minimum of space and are insulated from each other by any suitable nonconducting material such as mica or thin sheets of plastic, which are held together with De Kotinsky or plastic cement. All of the binding posts are equipped with standard 8-32 dry cell nuts.

The one disadvantage of this chamber is that it is not equipped with nonpolarizable electrodes. However, this type of electrode is rarely used in routine teaching of students. Furthermore, this disadvantage is more than offset by the speed with which the preparation can be put into use. A nerve-muscle preparation can be installed and all connections made in approximately two minutes. Moreover, with the humidity almost at the saturation point, a well-made nerve-muscle preparation will stay viable for several hours without any extra precautions being taken. Once the preparation is in the chamber, it need not be touched again for the duration of the experiment, thus eliminating any possibilities of mechanical or chemical damage which might give artifacts and other faulty results.

The lower right insert shows the back plate of a moist chamber in which two nerve-muscle preparations can be mounted simultaneously. This has a decided advantage over the single chamber, since it can be used on such experiments as the relative fatigability of the parts of the nerve-muscle preparations and on those in which one nerve is narcotized.

[1] This moist chamber was developed while the writer was teaching physiology at Georgetown University Medical School. A report was not published at that time because during the war years plastic material was not obtainable.

Homogenization of Sputum Specimens With a Paint-conditioning Machine

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To obtain adequate digestion of sputum with either dilute alkali or dilute acid, forceful agitation of the specimen is necessary. Sputum specimens can be shaken mechanically in the ordinary Kahn shaking machine, but much more thorough and rapid agitation is obtained by the use of a paint-conditioning machine. The adaptation of these rugged machines to sputum work was first suggested by Steenken and Smith (*1*) in 1942. At that time the 1-gallon capacity machine was recommended, the gallon container being arranged to accommodate 10 individual sputum bottles. Recently it has been found that a machine similar in type[1] but of 1-quart capacity can be utilized.

[1] Made by Landon P. Smith, Inc., Irvington, New Jersey.

The container is an ordinary 46-ounce tomato juice can cut down to a height of 13 cm. A tin cover is fabricated just large enough to telescope over the top of the can (Fig. 1). Also illustrated is the separator which slips inside the can and which consists of a central tin cylinder, with an inside diameter of 31 mm., surrounded by 7 vanes, each 3 cm. in width. The cylinder and vanes are 14 cm. in length.

A 50-cc. centrifuge tube, containing the sputum-sodium hydroxide mixture, is slipped into each compartment. Thus, 8 specimens can be shaken at one time. Two wide rubber bands (cut from an automobile inner tube) encircle the separator to help keep the tubes from rattling; a disc cut from rubber belting covers the bottom of the can.

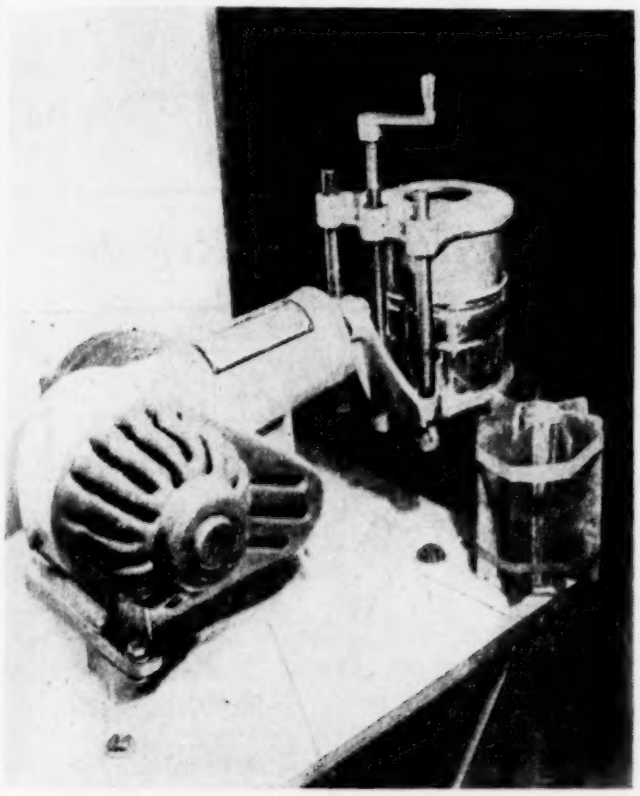

FIG. 1

The centrifuge tubes are of the round-bottom variety. They should be straight edge with no "pourout" lip. The tubes are closed with cork stoppers; rubber corks are not satisfactory. There should be an air space of at least 1 cm. between the top of the sputum-sodium hydroxide mixture and the bottom of the cork. When the corked tubes are in place in the can, there is always some variation in the total height of the various tubes with their corks. To compensate for this, a supply of cork discs of varying thickness is kept on hand, a disc of proper thickness being laid on top of each of the lower tubes. This leveling process does not have to be exact, since the telescoping cover, when screwed down tightly, will take up slight unevenness.

When the specimens are shaken in the paint-conditioning machine, complete homogenization is secured in 5–10 minutes. The same centrifuge tubes are used for spinning down the sediment.

Reference

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Estimation of Coenzyme I Through the Uptake of Oxygen

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A new method for the estimation of Coenzyme I has been worked out in which washed, dried brewer's yeast is used as the source of the enzymes, aldolase and triose phosphate apodehydrogenase. The substrate is hexose diphosphate, in the form of the potassium salt. Aldolase splits the hexose diphosphate into dihydroxyacetone phosphate and 3-phosphoglyceric aldehyde; the latter reacts with inorganic phosphate to give 1,3-diphosphoglyceric aldehyde. When Coenzyme I and methylene blue are now added, oxidation to diphosphoglyceric acid takes place, resulting in oxygen absorption, which is measured in the Warburg manometer. Oxygen absorption is steady for a period of 15–20 minutes. When different concentrations of Coenzyme I are employed, we find that if oxygen absorption in microliters during the first 15 minutes is plotted against the concentration in gamma of the coenzyme, the points lie more or less on a straight line (Fig. 1).

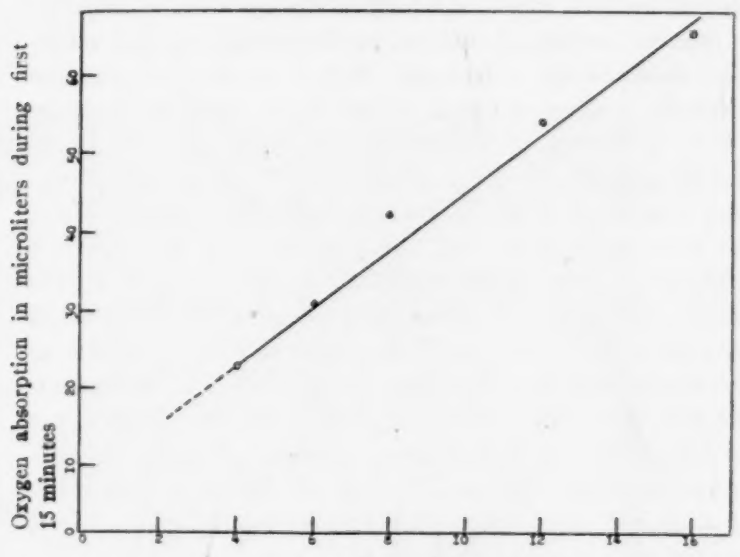

FIG. 1

It has not been possible to wash out the coenzyme completely from dried bottom yeast, but by the use of alkaline phosphate buffer we have succeeded in reducing blank oxygen absorption to a minimum, at the same time retaining maximal potency. There is no induction period, and the reaction is not altered appreciably by the absence of magnesium and manganese ions.

[1] The author's thanks are due to Prof. J. B. Sumner for his interest in the investigation and to the Haberle Brewing Company, Syracuse, New York, for generous supplies of bottom yeast.

Book Reviews

Practical chemistry for medical students. William Klyne. Baltimore: Williams & Wilkins, 1946. Pp. xvi + 459. (Illustrated.) $6.00.

This treatise on chemistry for medical students is intended to include sufficient chemistry for a proper understanding of the medical sciences of biological chemistry and pharmacology. It is based upon the English system of training medical students and is predicated upon the principle that this fundamental chemical information has not been taught the student prior to his entrance to the medical school.

The book is divided into five parts. Part 1 deals with fundamental scientific ideals, in which such subjects as the keeping of records, the logic of analysis, random variations, and statistical methods are introduced. Part 2, treating of practical methods, is devoted mainly to laboratory technics, melting-point determination, measurements from burettes, and distilling ranges. Part 3 embraces general and physical chemistry. The theory of ionization, acid-base equilibrium, hydrolysis, and colloid chemistry, and the principles of volumetric analysis and membrane equilibrium are embraced in this section. Part 4 includes descriptive inorganic chemistry along with the usual type of qualitative analysis found in textbooks on organic chemistry. The last section of the treatise presents the subject of carbon chemistry, tests for organic radicals, and an introduction to compounds of biological importance, such as carbohydrates, fats, and proteins. In addition, substances of medicinal value, such as acetanilide and sulfonamides, are treated with special emphasis.

Each chapter contains an interesting list of reference books for further reading.

On the whole, the book is well written and embraces a very wide field of chemistry in a manner seldom found nowadays in textbooks in this country.

The author appears to have accomplished the purpose for which the book was written, and in the opinion of the reviewer the subject matter of this text forms an excellent chemical foundation for students in medicine.

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The methods of plane projective geometry based on the use of general homogeneous coordinates. E. A. Maxwell. Cambridge, Engl.: at the Univ. Press; New York: Macmillan, 1946. Pp. xix + 230. $2.75.

This is a textbook on analytic projective geometry in the plane. Plane analytic geometry as ordinarily taught in the freshman year in universities and colleges in the United States is a reasonable prerequisite for understanding it. Although the author insists that he is primarily interested in the methods of projective homogeneous coordinates rather than in the geometrical content of the volume, he nevertheless gives a very satisfactory account of the theory of configurations constructed of points and straight lines, and his discussion of conics might even be called elaborate. Numerous exercises, taken mostly from old examinations, are provided, appropriate reference to the examination which served as the source of each such problem being given.

Doubtless the author had reasons which seemed to him adequate for including no geometrical figures, but to the reviewer it would seem to be good pedagogical practice to illustrate such a treatment with ample drawings and diagrams.

This scholarly work at an elementary level should be supplemented by a similar book on the analytic projective geometry of ordinary space.

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Scientific Book Register

FRIEDGOOD, HARRY B. *Endocrine function of the hypophysis.* New York: Oxford Univ. Press, 1946. Pp. iv + 233. (Illustrated.) $4.50.

GREENSTEIN, J. P. *Biochemistry of cancer.* New York: Academic Press, 1947. Pp. viii + 389. (Illustrated.) $7.80.

HAWK, P. B., OSER, B. L., and SUMMERSON, W. H. *Practical physiological chemistry.* (12th ed.) Philadelphia: Blakiston, 1947. Pp. xiv + 1323. (Illustrated.) $10.00.

HOSMER, RALPH S. *The Cornell plantations, a history.* Ithaca, N. Y.: Cornell Plantations Committee, Cornell Univ., 1947. Pp. xiv + 209. (Illustrated.) $3.00.

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